

SCIENCE

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FRIDAY, MAY 29, 1896.

THE APE-MAN FROM THE TERTIARY OF JAVA.*

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NEAR the beginning of last year, a discovery was announced that excited great interest throughout the scientific world, especially among those interested in the origin and antiquity of man. The announcement first made was that remains of a veritable missing link between man and the higher apes had been found in Java, in strata of Pleistocene age. The discovery was made by Dr. Eugene Dubois, a surgeon in the Dutch army, who had been stationed in Java for several years and had devoted much time to the vertebrate fossils of that island.

The first definite information received in this country was in December, 1894, when Dubois's memoir on *Pithecanthropus* arrived.† One of the first copies reached the late Prof. Dana, and at his request I wrote a review of it, which appeared, with illustrations, in the *American Journal of Science* for February, 1895.

The memoir of Dr. Dubois was an admirable one, and, although written in Java, with only limited facilities for consulting the literature on the subject, and for comparing the remains described with living

* Abstract of communication made to the National Academy of Sciences at Washington, April 24, 1896.

† *Pithecanthropus erectus*. Eine menschenähnliche Uebergangsform aus Java. Von Eug. Dubois, Militairarzt der niederlaendisch-indischen Armee. Mit zwei Tafeln und drei in den Text gedruckten Figuren. 4to, Batavia, 1894.

and extinct forms to which they were related, the author showed himself to be an anatomist of more than usual attainments and fully qualified to record the important discovery he had made. In my review, therefore, of this important memoir I endeavored to state fairly the essential facts of the discovery, as well as the main results reached by Dr. Dubois after a careful study of the remains. My own conclusions in regard to this discovery, briefly stated in my review, were as follows :

"It is only justice to Dr. Dubois and his admirable memoir to say here that he has proved to science the existence of a new prehistoric anthropoid form, not human indeed, but in size, brain power and erect posture much nearer man than any animal hitherto discovered, living or extinct. * * * Whatever light future researches may throw upon the affinities of this new form that left its remains in the volcanic deposits of Java during later Tertiary time, there can be no doubt that the discovery itself is an event equal in interest to that of the Neanderthal skull.

"The man of the Neander valley remained without honor, even in his own country, for more than a quarter of a century, and was still doubted and reviled when his kinsmen, the men of Spy, came to his defense, and a new chapter was added to the early history of the human race. The ape-man of Java comes to light at a more fortunate time, when zeal for exploration is so great that the discovery of additional remains may be expected at no distant day. That still other intermediate forms will eventually be brought to light no one familiar with the subject can doubt."

In most scientific quarters, however, both in this country and in Europe, Dr. Dubois's discovery was not received with great favor and the facts and conclusions stated in his memoir were much criticised. The early conclusions seemed to be that the various

remains discovered were human and of no great age ; that they did not belong to the same individual ; that the skull apparently pertained to an idiot, and that both the skull and femur showed pathological features. In fact, the old story of the distrust aroused by the discovery of the Neanderthal skull, nearly forty years before, was repeated, although in milder form.

It was a fortunate thing for science that the Dutch government appreciated the importance of the discovery made in its Javanese province by Dr. Dubois, and last summer allowed him to return to Holland and bring with him the precious remains he had found and so well described. Not only this, but he was also permitted to bring the extensive collections of other vertebrate fossils which he had secured from the same horizon and in the same locality where the *Pithecanthropus* was discovered. All these were shown at the International Congress of Zoölogists, held at Leyden, in September last, and on the 21st of that month Dr. Dubois read an elaborate paper on his original discovery and on his later explorations in the same region. This communication was in many respects the most important one of the session, and its presentation with the specimens themselves was a rare treat to the large audience present, especially to those fitted to appreciate the evidence laid before them.*

Prof. Virchow, of Berlin, was president of the meeting on that day, and had brought various specimens to illustrate the remarks he was to make in the discussion. The famous Leyden museum was also drawn upon for an extensive series of specimens of man and the higher apes, so that, if possible, the true position of *Pithecanthro-*

* *Compte-Rendu des Séances du Troisième Congrès International de Zoologie*, Leyden, September, 1895, pp. 251-271, 1896. See also *Transactions Royal Dublin Society*, Vol. VI., pp. 1-18, February, 1896; and *Anatomischer Anzeiger*, Bd. XII., pp. 1-22, 1896.

pus might then be determined once for all. Dr. Dubois, moreover, kindly invited Prof. Virchow, Sir William Flower and myself to come an hour before the meeting and personally examine the remains he was to discuss, and this invitation was most gladly accepted.

The first sight of the fossils was a surprise, as they were evidently much older than appeared from the descriptions. All were dark in color, thoroughly petrified, and the matrix was solid rock, difficult to remove. The skull-cap of *Pithecanthropus* was filled with the hard matrix, firmly cemented to it. The roughness of the superior surface, especially in the frontal region, was apparently due to corrosion after entombment, and not to disease, as had been suggested by some anatomists. The femur was free from matrix, but very heavy in consequence of the infiltration of mineral matter. The exostosis on its upper portion was a conspicuous feature, but of course is pathological. This feature is of little consequence, as very similar outgrowths occur on fossil bones of even Eocene age. The two teeth showed no characters that indicated their interment under circumstances different from that of the skull or femur. All the physical characters impressed me strongly with the idea that these various remains were of Tertiary age, and not Post-Tertiary, as has been supposed. The description of the locality and the account of the series of strata there exposed, as given by Dr. Dubois in his communication, confirmed this opinion, and a later examination of accompanying vertebrate fossils placed the Pliocene age of all beyond reasonable doubt.

The facts relating to the discovery itself, and the position in which the remains were found, as stated by Dubois in his paper, together with some additional details given to me personally, convinced me that, in all probability, the various remains attributed

to *Pithecanthropus* pertained to one individual. Under the circumstances, no paleontologist who has had experience in collecting vertebrate fossils would hesitate to place them together.

The three specimens originally described, the tooth, skull and femur, were found at different times in the same horizon, all imbedded in the same volcanic tufa, in the bank of the river Bengawan, near Trinil, in central Java. The tooth was found first, in September, 1891, in the left bank of the river, about a meter below the water level during the dry season, and twelve or fifteen meters below the plain in which the river had cut its bed. A month later, the skull was discovered, only a meter distant from the place where the tooth lay. In August, 1892, the femur also was found, about fifteen meters distant from the locality where the other specimens were imbedded. Later, in October of the same year, a second molar was obtained at a distance of not more than three meters, from where the skull-cap was found, and in the direction of the place where the femur was dug out.

The fossils thus secured were all carefully investigated by Dubois, who regards them as representing a distinct species and genus, and also a new family, which he has named the *Pithecanthropidae*, and distinguished mainly by the following characters:

Brain cavity absolutely larger, and, in proportion to the size of the body, much more capacious than in the *Simiidae*, yet less so than in the *Hominidae*. Capacity of the skull about two-thirds the average of that of man. Inclination of the nuchal surface of the occiput considerably greater than in the *Simiidae*. Dentition, although retrogressive, still of the simian type. Femur equal in its dimensions to that of man, and like that adapted for walking in an upright position.

Of this skull, the upper portion alone is preserved, the line of fracture extending

from the glabella backward irregularly to the occiput, which it divides somewhat below the upper nuchal line. The cranium seen from above is an elongated oval in

guished from that of other anthropoid apes by its large size and its higher arching in the coronal region, as shown below in figures adult, but not very old, animal. The crown

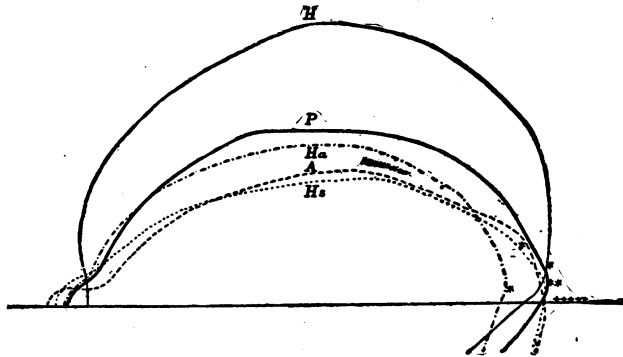


FIG. 1.—Longitudinal outlines of crania. H. European man; P. *Pithecanthropus*; Ha. *Hylobates agilis*; A. Chimpanzee; Hs. *Hylobates syndactylus*. (After Dubois.)

1 and 2. The greatest length from the glabella to the posterior projection of the occiput is 185 mm. The greatest breadth is 130 mm, and the smallest, behind the orbit, is 90 mm. The cranium in its original condition must have been of somewhat larger dimensions. The upper surface of the skull is without ridges, and the sutures all appear to be obliterated.

This dolicocephalic skull, with an index of 70°, is readily distinguished from that of the Orang-utan, which is decidedly brachycephalic. The absence of the characteristic cranial crests will separate it from the skull of the adult Gorilla. In its smooth upper surface and general form, it shows a resemblance to the skull of the Chimpanzee, and still closer to that of the Gibbons (*Hylobates*).

A figure of the present specimen and the skull of a Gibbon for comparison are shown in figures 2 and 3, below, reproduced from illustrations in Dr. Dubois's memoir.

The tooth, the first specimen found, is represented in figure 4, below. It is the last upper molar of the right side, and is in good preservation. It indicates a fully outline, dolichocephalic; and is distin-

is subtriangular in form, with the corners rounded, and the narrowest portion behind. The anteroposterior diameter of the crown

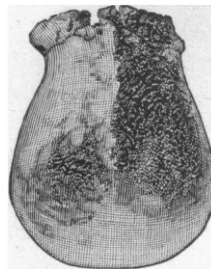


FIG. 2.—Cranium of *Pithecanthropus erectus*, $\frac{1}{3}$.



FIG. 3.—Skull of *Hylobates syndactylus*, $\frac{1}{3}$. (After Dubois.)

is 11.3 mm, and the transverse diameter 15.3 mm. The grinding surface of the crown is concave and less rugose than in existing anthropoid apes. The diverging roots are a simian feature.

The femur, which is from the left side, is in fair preservation, although it was somewhat injured in removing it from the surrounding rock. It belonged to a fully adult individual. In form and dimensions it resembles so strongly a human femur that

only a careful comparison would distinguish one from the other.

These various remains of *Pithecanthropus* were again described in detail and compared with allied forms by Dr. Dubois in his paper at Leyden, and in the discussion that followed the whole subject was once more gone over by anthropologists, zoölogists and geologists in a most thorough and judicial manner. To attempt to weigh impartially the evidence as to the nature of *Pithecanthropus*, presented by Dr. Dubois in his paper and by those who took part in the critical discussion that followed its reading, would lead far beyond the limits



FIG. 4.—Third right upper molar of *Pithecanthropus erectus*, ♂. (After Dubois.)
a, back view; b, top view.

of the present communication. I can only say that this evidence was strongly in favor of the view that the skull of *Pithecanthropus* is not human, as the orbital and nuchal regions show, while at the same time it indicates an animal much above any anthropoid ape now known, living or extinct. Opinions differed as to whether the various remains pertained to the same individual, but no one doubted their importance.

The varied opinions expressed in regard to the anatomical characters of each of the specimens have already been published, and need not be repeated here. Dr. Dubois, in his papers above cited, has met all the principal objections made to his views since he announced his discovery. He has also given full reference to the literature, which promises to be voluminous as the importance of the subject becomes better known.

After a careful study of all the *Pithecan-*

thropus remains and of the evidence presented as to the original discovery, the position in which the remains were found, and the associated fossils, my own conclusions may be briefly stated as follows:

(1) The remains of *Pithecanthropus* at present known are of Pliocene age, and the associated vertebrate fauna resembles that of the Siwalik Hills of India.

(2) The various specimens of *Pithecanthropus* apparently belonged to one individual.

(3) This individual was not human, but represented a form intermediate between man and the higher apes.

If it be true, as some have contended, that the different remains had no connection with each other, this simply proves that Dr. Dubois has made several important discoveries instead of one. All the remains are certainly anthropoid, and if any of them are human the antiquity of man extends back into the Tertiary, and his affinities with the higher apes become much nearer than has hitherto been supposed. One thing is certain: the discovery of *Pithecanthropus* is an event of the first importance to the scientific world.

O. C. MARSH.

THE METRIC SYSTEM.

THE issue of SCIENCE for May 15th contains the report of a meeting of the Engineers' Club of Philadelphia, at which, by a vote of 100 to 60, the Club urges upon Congress the adoption of the metric system as the only legal standard in the United States, and the promotion of such international coöperation as will provide unity of practice among commercial nations.

In connection with this it may be of interest to note the issue of a circular entitled 'Should the metric weights and measures be made compulsory?' It is signed by J. Emerson Dowson, of London, who is a member of the Institute of Civil Engineers and Chairman of the Executive Committee

of the New Decimal Association in England. This circular has been sent to various members of the American Society of Civil Engineers.

Mr. Dowson begins by quoting the now well-known recommendations of the Select Committee of the House of Commons, reported last July, in which it was urged that the metric system be at once legalized in England; that it be taught in all public elementary schools, and that it be rendered compulsory by act of Parliament after a lapse of two years. He discusses the reply of Mr. Balfour to the deputation of the Chamber of Commerce, who had urged upon him the need of giving effect to the recommendations of the Select Committee. Mr. Balfour expressed his high opinion of the merits of the metric system, but was unwilling that this should be made compulsory in the near future, because he feared the effect on the small retail dealers and those who buy their goods from such dealers, and thought that so important a change could not be well undertaken until public opinion is better prepared for it than at present. The metric system was legalized in America nearly twenty years ago, but in England its use is forbidden, under penalty, for purposes of trade. With us the pound and yard are defined as certain decimal fractions of the kilogram and meter, respectively, but neither legalization nor definitions are sufficient to secure general adoption until the people feel the need of discarding the inconsistencies and inconveniences to which they have become accustomed in the use of English weights and measures. Mr. Dowson's circular shows that among the plain business people of England there is an unexpectedly widespread demand for the change, in relation to which Mr. Balfour has shown himself so conservative. Soon after Mr. Balfour's reply had been given to the Deputation, the Metropolitan Grocers' and Provision Deal-

ers' Association, a body composed chiefly of retailers, had a general meeting, discussed the metric system fully and critically, and passed a resolution, amidst applause, "That after due notice the system be made compulsory after two years." The Trades Councils throughout England seem to have taken a lively interest in the question. "At several of their meetings it had been discussed in a practical way; and at a Congress held in Glasgow, where there were 495 delegates, representing about a million and a quarter members and 418 different trades, a resolution in favor of the proposed change was carried unanimously, and the Parliamentary Committee was instructed to give it active support. These Trade Councils represented bargemen and watermen, dockers, street masons and pavers, gas workers and laborers, boot and shoe workers, lithographic printers, carmen, shop assistants, railway servants and many provincial trades." "The Incorporated Society of Inspectors of Weights and Measures have passed a strong resolution in favor of the proposed change. This Society represents the inspectors from all parts of the Kingdom and they have an intimate knowledge of what is best for the retail trades." "The County Council of Durham, representing a population of 750,000, voted unanimously in favor of the change; and one notable feature is that on this Council there are twenty working miners."

Mr. Dowson's circular is accompanied by a list of public bodies, associations, etc., which have approved the adoption of the metric system in England. This list is surprisingly large, and represents an amount of strength in behalf of progress much beyond what most of us Americans have credited to the conservative English. There are 20 town councils; 40 trade councils, including the London Association for the Protection of Trade, consisting of 4,000 members, the Edinburgh Merchants' Asso-

ciation, the Association of Trade Protection Societies, the Liverpool Cotton Association, Corn Trade Association, etc.; 29 School Boards, including those of London, Manchester and Birmingham; 39 Chambers of Commerce, including those of London, Edinburgh, Liverpool, Birmingham and Belfast; and 15 other influential bodies not easily classified, such as the National Union of Teachers, the Scottish Chamber of Agriculture, the Institution of Engineers and Shipbuilders, etc. Approval of the compulsory adoption of the metric system was carried at the Congress of Chambers of Commerce of the Empire, and at the recent annual meeting of the Association of Chambers of Commerce (March 25, 1896), when the Earl of Dudley assured the meeting that the London Board of Trade, of which he is Parliamentary Secretary, "realized the importance of the question and was determined to press it to an issue as soon as possible."

Apart from the inconvenience involved in change of any kind, the only really serious objection to the general adoption of the metric system is found in the great expense that is brought into large manufacturing establishments by a change of standards. The English are beginning to appreciate the loss they are suffering by lack of harmony with most other European nations, and loss of trade soon teaches what expense may be afforded in changing standards. The facts brought out in Mr. Dowson's circular seem to show that in England at present the popular demand for the metric system is greater than it is in America, although as a people we are less conservative than the English. Despite the temporary discouragement lately suffered by the advocates of progress in metrology, the outlook among English-speaking peoples is, on the whole, far better than it has ever been in previous years; and without being unreasonably sanguine there is yet good ground

for the expectation that in both England and America the metric system will have been adopted by popular demand with the opening of the twentieth century.

Lord Kelvin's letter to the *London Times*, quoted in the last issue of SCIENCE, deals with this subject in a spirit eminently characteristic of its author and worthy of special commendation to American legislators. It thoroughly disposes of Mr. Balfour's consideration that the introduction of the metric system would bring hardship upon the poorer classes, "who have no great power to make their voices heard, at least in such discussions as these." Any argument based on the interests of these classes in England is equally applicable in America or in Germany. Those of us who have dwelt some time in Germany have noticed how thoroughly the poorer classes have adapted themselves to the metric system. There is certainly no record of their having suffered any unreasonable hardship. Indeed this is the old argument against the introduction of all labor-saving devices. If it had prevailed we should not to-day be using the power loom, the cotton gin, the steam engine or the printing press, because each of these threw some of the poorer classes out of employment, or necessitated inconvenient change of employment for them.

In the present case, moreover, there is no special need that the poorer classes should 'make their voices heard.' To form any opinion upon the merits of the metric system it is necessary to have some knowledge of it practically. Any one who has such knowledge, if he belongs to the poorer classes, should be accorded the opportunity to be heard. In America every one, however poor he may be, has access to the public ear through the daily press if he has the ability to write intelligibly. But the poor and the uneducated cannot be expected to take any active part in discussions of this kind, any more than in the founding of

universities or the establishment of monetary systems. If we wait for them to speak out we must wait indefinitely. If the introduction of the metric system be accomplished in America we must act in the light of experience already acquired in Europe, which is far more valuable than any amount of theorizing about the apprehended effect upon poorer classes who have not yet tried it.

The suggestion that an International Commission should be appointed to secure unity of action between the United States and Great Britain is eminently worthy of adoption. Any system of metrology adopted by one of these two nations must necessarily be adopted nearly, if not quite, simultaneously by the other. It is very much to be desired that this proposition shall be brought before Congress as soon as the Committee on Coinage, Weights and Measures is again ready to act.

W. LE CONTE STEVENS.

TWO EROSION EPOCHS—ANOTHER SUGGESTION.

HERSHEY's recent suggestion (*SCIENCE*, Vol. III., pp. 620-622) that a specific designation be given to the epoch of post-Lafayette erosion in the eastern United States is an excellent one. The epoch is one of the most clearly defined in the physical history of the continent; its record has already been interpreted over a vast area, and a specific designation will tend at once to crystallize knowledge and to aid in its diffusion. So the suggestion marks an advance in systematizing American geology.

To the writer the name selected seems hardly a happy one, partly because 'Ozark' is already in so general use in geologic nomenclature as perhaps to occasion confusion, partly because there is a certain incongruity in applying the name of a mountain region to a degradation period; but this question of fitness in name gives no occa-

sion for hesitating to adopt the suggestion.

There is a graver question concerning the age of the epoch. Hershey intimates, without argument, that there is 'general agreement * * * that the post-Lafayette period of erosion is early Quaternary in age;' but, so far as the writer is aware, most students have connected the degradation period with the preceding aggradation period—those geologists who have examined the formation and its degradation record (with perhaps two exceptions) regarding both as pre-Quaternary, and those who have written voluminously on the formation without seeing it regarding it as Quaternary. It seems worth while to direct attention to this question of age, partly for the purpose of pointing out that there is no less need for the term even if the epoch does not belong to the Pleistocene, and thus to the period so well classified by Chamberlin; it is not absolutely necessary to decide whether the Ozarkian epoch be classified as Pleistocene or Neocene, since each student can arrange his pigeon holes and their contents as he pleases, and since increasing knowledge is constantly making toward better arrangements; but it is important that this well-marked erosion epoch should bear a denotive label. It is also important to remember that, if erosion be regarded as yielding a time measure, the reference of the Ozarkian to the Pleistocene multiplies many times the commonly recognized duration of that period.

Hershey adequately recognizes the extent of the erosion affected during the Ozarkian epoch in (a) the Coastal plain of the Atlantic and Gulf, and (b) the broad area extending thence to the glacial margin; but it seems desirable to recognize (hypothetically perhaps, but with constantly increasing evidence), the record of the epoch in (c) the glaciated region: In the Coastal plain this epoch of profound erosion is recorded in estuaries hundreds of miles in length and

scores in breadth, and scores or hundreds of feet in depth to the bottom of later linings, excavated chiefly in nonlithified deposits; in the interior area it is recorded in steep-bluffed canyons carrying all the rivers and all but the smallest streamlets, excavated in hard rocks; and the two records are not only consistent in kind and amount, but intergrade in such manner as to establish substantial identity. In the glaciated area the drift mantles a surface, which, so far as outcrops and borings indicate, is the counterpart of that found in the extra-glacial region, *e. g.*, in Ohio and western Pennsylvania numerous ancient drift-filled channels have long been known; in Indiana and Illinois many such canyons have been revealed by borings; in Iowa several have been recognized for years and others have recently been brought to light through the researches of the State Survey; indeed throughout most of the glaciated region such buried canyons are known. Now it is noteworthy that all of these drift-filled gorges thus far brought to light are consistent in depth and width among each other, and also with the gorges of the Mississippi, Missouri and Ohio, not only inside the glacial boundary, but outside that limit where they form trustworthy records of the Ozarkian epoch. It is no less noteworthy that Salisbury and others have detected remnant gravel deposits, presumptively representing the Lafayette, far within the glacial boundary; and the combined records of aggradation and degradation indicate with considerable clearness that the continental oscillations of the Lafayette-Ozarkian time affected most or all of what is now the eastern half of the United States. This correlation of degradation records without and within the glacial boundary explains simply and readily the peculiar configuration of the pre-glacial surface which has puzzled many students; and at the same time it emphasizes the strong distinction between agen-

cies and conditions of the two periods—the Ozarkian epoch of high level and rapid degradation, and the Kansan and succeeding epochs of low altitude and aggradation or feeble degradation.

In considering the physical history of the southeastern quarter of the continent during neozoic time it should be borne in mind that there were two and only two great eons or cycles of earth movement. The first eon began with the profound oscillations attending the deposition and subsequent degradation of the Potomac formation, continued with ever-lessening amplitude of oscillation nearly to the end of the Tertiary, and closed with the remarkable epoch of stability in the earth crust antedating the Lafayette; the second eon began with the profound oscillation by which the deposition and subsequent degradation of the Lafayette were produced, continued with diminishing vigor and amplitude of movement to the end of glacial time, and is apparently not yet closed, *i. e.*, each cycle began with strong movement which gradually declined and died away, the first in a long epoch of quiescence, the second in the gentle oscillation apparently in progress to-day. It may be noted in passing that there is a certain logical symmetry and completeness in correlating these eons or cycles with the stratigraphic and paleontologic series, and thereby in referring the second wholly to Pleistocene; but it should not be forgotten that there is no indubitable evidence connecting the Lafayette with glacial action, and a vast body of trustworthy evidence pointing in the opposite direction, so that the logic of fact runs counter to the logic of idea; moreover such a correlation tends to deepen the slough of baseless speculation concerning the cause of glaciation which alone seems to connect the Lafayette with the glacial deposits. Now on considering in detail the oscillations of the two eons, it is found that they run in

pairs, each subsidence being followed by elevation of proportionate amount; * *e. g.*, the strong subsidence of the Potomac epoch was followed by a strong uplift, the slight subsidence of the Pamunkey by a slight uplift, and in the Lafayette and again in the Columbia epoch the same relation held, while the values of subsidence and elevation varied together in different latitudes, yet remained essentially equal at each. So uniform and so constant is this relation that it seems fitting to couple each degradation period with the immediately preceding aggradation period rather than with that which followed; in other words, each unconformity seems more closely related to the formation in which it is carved, than to the newer, perhaps much newer, formation overlying it. These considerations indicate the conditions of the erosion epochs preceding and succeeding the Lafayette; and incidentally they seem to afford additional grounds for classing the Ozarkian epoch with the Neocene rather than with the Pleistocene.

There is satisfactory evidence† that as the oscillating earth crust came to approximate rest in the earlier physical eon, the land surface throughout the Piedmont, Appalachian, Cumberland and contiguous provinces was extensively baseleveled and so far degraded that mechanical agency became feeble; this was the epoch of widespread planation by which character was given to the inter-stream surface outside the glacial margin, and presumptively to the inter-canyon surface in the glaciated area. As mechanical activity decreased chemical activity increased, and the less

obdurate rocks were decomposed into a thick mantle of residua, interrupted by occasional siliceous ledges and bodies, which were afterward gathered by the revived streams to form the Lafayette deposit. This epoch of baseleveling and rock decomposition was of exceeding importance in the geologic history of the southeastern part of the continent, since it was during its course that the chief topographic features of the provinces—the broad plateaus and inter-stream plains—were developed. Its earlier limit is indeed somewhat vague; the characteristic processes began with the waning post-Potomac oscillation, and were measurably interrupted by each throes of the earth crust up to and including the Chesapeake, in the middle Atlantic slope; but its later limit is clearly fixed by the Lafayette.

It seems desirable that this important degradation epoch should receive a distinctive appellation. The association of Hershey's designation would suggest Appalachian, or Piedmont, or Cumberland as a suitable term, since the configuration of these provinces was shaped during the epoch; but it would seem to the writer more fitting to borrow a name from one of the principal agents in the work of the epoch, viz: Tennessee river—a great waterway which then drained a large section of the Cumberland and Appalachian provinces directly into the Mississippi, which was of much greater importance in the earlier neozoic epochs than at present, and which assumed a new course in its lower part and lost much of its drainage area as the epoch ended.

So it may be suggested that *Tennessee* (or *Tennesseean*) epoch be added to the time nomenclature of American geology as a designation for the long period of planation and rock decomposition immediately preceding the Lafayette. Thus may we have convenient designations for the two chief erosion periods by which the lands of a vast area of our continent were finally shaped.

* The characteristics of the movements have been noted in the *Compte Rendu de la Congress Géologique International*, 5me. Session, Washington, 1891, p. 165.

† Noted in part in Twelfth Ann. Rep. U. S. Geol. Survey, 1891, pp. 494-6, 508; also in descriptive text of the *Nomini Atlas-folio* (now in press) of the *Geologic Atlas of the United States*.

The relations of the epochs, as conceived by the writer, are shown in the following scheme :

<i>Period.</i>	<i>Epoch.</i>	<i>Process.</i>
Pleistocene	Wisconsin . . .	Glaciation.
	Toronto ? . . .	Aqueous erosion, etc.
	Iowan	Glaciation.
	Aftonian	Aqueous erosion, forest growth, etc.
	Kansan	Glaciation.
Neocene	Ozarkian	Canyon cutting.
	Lafayette	Sedimentation.
	Tennessee . . .	Planation.

Save occasionally in the Appalachian and Piedmont provinces, where the normal land forms are locally dominated by structural mountains, monadnocks and catoctins, the topographic record of the two Neocene erosion epochs stands out in every typical landscape from the fall-line to the drift margin ; for the characteristic tabular or gently-rounded, residuum-mantled divides represent the earlier, and the no less characteristic steep-bluffed labyrinthine gorges represent the later epoch. The even-topped ranges and outlying monadnocks record earlier episodes in continental development, as Davis, Hayes, Campbell and others have shown; but the record found in the relatively modern plateaus and gorges is many times the more extensive and impressive.

Howsoever the Ozarkian be classified, it is evident that the erosion epochs of the Pleistocene and Neocene were long, especially in the earlier time. Recent researches, notably by Chamberlin and others in the interior and by Salisbury in New Jersey, indicate that the Toronto epoch was much longer than the post-glacial epoch; and it has for some time been recognized by a number of glacialists that the interglacial epoch called Aftonian was much longer, as measured by erosion, than all those that have followed—or, at any rate, that the Kansan was many times more remote than the Wisconsin. Yet the erosion of the Toronto and Aftonian together is trifling in comparison with the profound and

widespread canyon-cutting of the Ozarkian, during which the streams and larger rivers of the southeastern sub-continent cut gorges averaging 250 feet in depth and ranging from a few rods to several miles in width; and even this enormous erosion is slight in comparison with the widespread wasting of the Tennessee epoch.

W J MCGEE.

CURRENT NOTES ON PHYSIOGRAPHY.

GEOGRAPHICAL DESCRIPTION OF THE BRITISH ISLANDS.

DR. H. R. MILL gives in the April *Geographical Journal* an account of his plan for a series of memoirs, one for each sheet of the one-inch ordnance survey, describing the geography of the British Islands in a most comprehensive manner. Index of names and locations, mean elevations, hypsographical description, physiographical explanation, areas of woodland, moorland, cultivated land, etc., political and historical boundaries and events, geographical description proper, and bibliography, are to be duly considered. The plan was favorably commented on at a meeting of the Royal Geographical Society, and it does not seem impossible that it may be carried into execution.

The remark made under 'historical information' might be applied to all parts of the plan: It 'would be very stringently edited, so as to confine it strictly to those features and events of direct geographical importance,' for an inspection of current geographical literature shows how vague is the prevalent conception as to the essential quality of geographical discipline. Local floras and faunas, one of the proposed topics, are distinctly not geographical, but biological subjects. Treated with relation to the controls of their distribution, they gain geographical flavor. Treated as exhibiting geographical controls, they become as distinctly geographical as are any other means

of impressing the facts concerning the earth's surface. It may be questioned whether the 'mean elevation of areas between successive contour lines' is a worthy object of geographical as contrasted with arithmetical study. It only produces confusion to tabulate under one heading a steep and a flat slope of the same limiting altitudes; but it is quite otherwise with the summation of steep and of flat areas, under appropriate but not arbitrary limits of height. A remark under this heading also might be generally applied to the whole project: "It would be very suitable as an exercise and training for students, if any institution existed in this country where students would be induced to study geography seriously." The geographical description "would be the most important part of the memoir, and must be the work of a trained geographer. * * * It would deal directly with the relation of the people to the land, showing the control exerted by geographical conditions on the sites of towns, on dwellings, occupations, the distribution of the people, the lines of communication."

Let us hope that Dr. Mill's excellent project need not wait until that distant time when trained geographers are found, ready made; but that the Royal Geographical Society will at once announce that it is ready to publish chapters of these memoirs, by whomsoever prepared, but accordant with a systematic and comprehensive plan, and approved by a committee of editors. Almost any one of the chapters might be chosen as the subject for a candidate's thesis for his doctorate, and this kind of encouragement of serious geographical study might well serve as the thin end of the wedge that shall farther open up the proper development of geography in the English universities.

RECENT SHEETS OF OUR NATIONAL MAP.

THIRTY odd sheets of the topographical map, in preparation for our national geo-

logical atlas, are lately added to the growing list of surveyed areas. The limestone country of Florida is revealed as showing typical '*Karst*' forms, without continuous valleys, but discharging its surface waters by underground channels, entered through sinkholes. Although a faint relief, it rivals in perfection of this kind of form the more famous *Karst* district of Carniola. Kingfisher sheet, Oklahoma, exhibits a peculiar relation between Cimarron river, on the north, and the North fork of Canadian river, lying twenty miles further south and 300 feet higher; the branches of the former river heading within two or three miles of the latter and bidding fair to capture and divert it at various points. The downstream deflection of tributary streams is well illustrated in the case of Bird creek, which, when less than half a mile from the Cimarron, turns and flows six miles southeast along the margin of the flood plain before entering the main river, and indeed then enters it only because the river crosses to the southern side of its flood plain and picks the tributary up; thus repeating on a small scale the much larger example of the Yazoo and the Mississippi. The Oneida and Oriskany sheets, N. Y., might be commended to the author of the statement that "three distinct mountain masses enter New York from the south and extend across it in a general northeast direction." These sheets show in part the definite northern termination of the Alleghany plateau south of the Mohawk valley, in bluffs that ascend six or seven hundred feet. The second sheet includes the greater part of the 'long level' in the Mohawk valley, below Rome; of particular interest as the outlet of the expanded Lake Ontario in late glacial times. Many other sheets equally deserve comment.

A SHORT HISTORY OF THE GREAT LAKES.

UNDER the above title, F. B. Taylor is contributing several articles to the *Inland*

Educator (Terre Haute, Ind.) in the hope of cultivating an appreciative study of local physiography in the Indiana schools. In the April number, two outline maps exhibit hypothetical restorations of several stages of the glacial lakes in relation to the moraines, the retreating ice front and the temporary outlets. As several of the terminal moraines constitute the most important local reliefs of the level prairies of Indiana, and as one of the earlier lakes overflowed across northern Indiana to the Wabash and thence to the Ohio, passing the site of Fort Wayne, the subject is a pertinent one for an educational journal, and deserves more emphasis than it commonly receives in the schools. The Science department of the *Educator*, conducted by Prof. C. R. Dryer, of the State Normal School at Terre Haute, proposes to follow Taylor's essay with others of local physiographic bearing prepared by investigators of acknowledged competence, and in this plan they set a good example that deserves imitation.

W. M. DAVIS.

HARVARD UNIVERSITY.

CURRENT NOTES ON METEOROLOGY.

WEATHER BUREAU KITE-FLYING.

THE past year has witnessed a very notable development in scientific kite-flying in this country. In Washington the Weather Bureau has, under the direction of Prof. Willis L. Moore, Chief of the Bureau, been carrying on an extended investigation into the best kinds of kites for use in sending up meteorological instruments. Prof. C. F. Marvin has recently minutely described the kind of kite now in use by the Bureau (*Mo. Weather Rev.*, Nov., 1895). This kite is a modification of those used by Hargrave in Australia, and is not at all like the ordinary kite. Instead of being flat, and tapering at the lower end, as in the usual form, these kites are box-shaped, with their ends open and their sides partly covered with

cloth or silk. This style of kite, which has also been in use at Blue Hill for some months, is found to be admirably adapted to the purpose for which it is intended, and when fine piano wire is used to hold it, instead of twine, is a splendid flyer. The next few years will undoubtedly witness many improvements in kites used for meteorological purposes, and the United States seems to be distinctly in the lead in this work at the present time.

BALLOONS AND KITES IN CLOUD OBSERVATIONS.

IN connection with the cloud observations to be made during the International Cloud Year (see *SCIENCE*, May 1, 1896, 661) the suggestion is made by Kremser (*Meteorologische Zeitschrift*, April, 1896, 143-144) that the extended use of small pilot balloons would result in giving us much valuable information as to the air currents in and around clouds. These balloons, which can be made at slight expense, reach considerable altitudes, and are especially useful in indicating the drift of the air currents when there are no clouds in the sky, the direction of the lower currents when only upper clouds are visible, etc. Clayton, of the Blue Hill Observatory, has for some time been using kites to help in determining the altitudes of the base of stratus and nimbus. These clouds, which so often cover the whole sky with a uniform sheet, can only have their heights determined under the most favorable circumstances if the ordinary theodolite is used.

BLUE HILL KITE-FLYING.

THE work done at Blue Hill Observatory with kites was outlined by Clayton before the Boston Scientific Society at a recent meeting (Boston Commonwealth, May 9, 1896, 12-13). The kites at present in use are the Eddy, or tailless, and the Hargrave, or box kite. Continued experiments at Blue Hill have resulted in the development

of scientific kite-flying on a remarkable scale. Recent ascents have reached altitudes but little short of a mile above sea level, and excellent records have been obtained by means of a self-recording instrument made by Fergusson, of the Blue Hill staff, which gives automatic readings of temperature, pressure, humidity and wind velocity. Mr. Rotch, the proprietor of the Observatory, has now had constructed for him by Richard *Frères*, of Paris, an aluminum instrument weighing less than three pounds, which records pressure, temperature and humidity. The meteorological results already obtained are of great value, and the full discussion of them is awaited with interest. Among the most important matters that have been noted is the presence of cold waves and warm waves at considerable elevations some hours before the temperature changes are noted at the earth's surface. The prospect of improving our weather forecasts by such soundings of the free air is very encouraging, and it is more than likely that before long some practical use will be made of these discoveries.

HARVARD UNIVERSITY. R. DEC. WARD.

SCIENTIFIC NOTES AND NEWS.

THE fifth session of the Hopkins Seaside Laboratory, of Stanford University, will open on June 15th. It will continue for six weeks, but investigators may remain in residence throughout the summer. The laboratory, which includes two buildings well equipped for instruction and research, is located at Pacific Grove, on the Southern shore of Monterey Bay, about four hours' distant from San Francisco. To investigators prepared to carry on original work the use of the Laboratory and its equipment is tendered free of charge, and its location offers unusual advantages to students from the Eastern States wishing to become acquainted with the fauna and flora of the Pacific. The laboratory is under the direction of Professor O. P. Jenkins and C. H. Gilbert, with the assistance of other instructors from Stanford University.

MR. GRIFFITH, Secretary of the British Association for the Advancement of Science, is now in America to make arrangements for the meeting of the British Association in Toronto in 1897. On May 19th he was the guest of Prof. Putnam, Permanent Secretary of the American Association for the Advancement of Science. The two Secretaries passed the morning in discussing various matters relating to their respective Associations. It is the intention of the American Association to arrange the time and place of its meeting next year so that members of the American and British Associations can attend both meetings, and as the British Association will probably hold its meeting on August 18-25 it is suggested that the American Association hold its meeting August 30 to September 4. A few Harvard professors, prominent in the Association, met Mr. Griffith at the Colonial Club, and the afternoon was spent in visiting several departments of Harvard University. On Wednesday Mr. Griffith visited the Harvard Medical School and other places of interest in Boston, and in the evening he left for Ottawa in order to meet the members of the Royal Society of Canada before their adjournment on Friday. From there he goes to Toronto to arrange with the local committee for the meeting of the British Association.

THE Secretary of the Smithsonian Institution has leased for another term of three years, for the benefit of American students, one of the tables at the Naples Zoölogical Station. This was done in response to requests from a large number of colleges and universities, and to resolutions from the principal natural history societies in the country, and a petition signed by over four hundred biologists. During the last three years the following universities and colleges have been represented; that is to say, the occupants of the Smithsonian table have been either graduates of those universities or professors in their faculties:

Clark University, Worcester; University of Chicago; Brown University; University of Michigan; Kentucky State College; John Hopkins University; Kansas Agricultural College; Bryn Mawr College; Wesleyan University; Iowa Agricultural College; Leland Stanford Junior University; Olivet College, Michigan.

The candidates for the privileges of the Smithsonian table are recommended by a committee composed of representatives of the *National Academy of Sciences*, *American Morphologists*, *Society of American Naturalists* and the *Association of American Anatomists*.

MR. HERBET SPENCER has recently communicated to the *London Times* a series of letters opposing the adoption of the metric system and advocating a reorganization of the present duodecimal system in preference to a change which would adjust our weights and measures upon a decimal system.

WE noted last week that in the occasion of its millennial celebration the University of Buda-Pesth will confer an honorary degree upon Dr. John S. Billings. It is said that degrees will not be conferred on any other Americans and only on four Englishmen: Lord Kelvin, Mr. Herbert Spencer, Prof. Max Müller and Mr. James Bryce.

PROF. W. K. BROOKS has been elected Fellow of the Royal Microscopical Society.

A TELEGRAM to the New York *Evening Post* states that there has been a volcanic eruption on the island of Socorro, off the Mexican coast. Two months ago, which is the latest date of news received, lava was running down the mountain sides, overflowing the lowlands and moving towards the sea.

GOV. MORTON has signed the bill authorizing the use of the land now occupied by the old reservoir at Forty-second street and Fifth avenue in New York City for a free public library and reading room, to be erected under the supervision of the New York Public Library, the combination of the Astor, Lenox and Tilden foundations.

A NEW law authorizes the Brooklyn board of estimate and apportionment to grant \$100,000 payable on the Mayor's order, to any corporation depositing an equal amount with the City Treasurer for the purpose of a free public library.

PROF. KEMP and Prof. Peale, of Columbia University, will conduct the summer work in geology and mining of the School of Mines at Butte, Montana. Prof. Scott, of Princeton University, will conduct a geological expedition

which will have its headquarters at Flagstaff, Arizona.

PROF. D'ARCY THOMPSON and Mr. Barrett Hamilton have been appointed by the British government as the naturalists to investigate the seals in Behring Sea. They are now on their way to the United States.

THE British Government, in recently distributing a number of sets of the Challenger Reports to scientific institutions, selected on the advice of the council of the Royal Society, sent five of the sets to the United States. The Institutions which receive them are the Universities of California, Tulane and Colorado, the Woods Holl Laboratory and the Hydrographic Bureau of the United States Navy.

THE Museum of Practical Geology, London, will be opened on Sunday, from 2 p. m. to 7 p. m., as an experiment, the continuance of which will depend on the attendance of visitors.

AN International Congress of Agriculture will be held at Buda-Pesth in connection with the Millennial Exposition. An International Horticultural Exposition will be held at Hamburg from May to October, 1897. The sum of \$100,000 has been appropriated for the purpose by the city.

THE publication is announced of a journal in Milan devoted to acetylene and its applications.

THE *British Medical Journal* states that the Koch Institute is not to be transferred to Dahlem after all. The Prussian government has decided to buy a plot of land close to the ground on which the new fourth municipal hospital is to be erected—in the See Strasse—and to build an enlarged and improved Koch institute upon it. The decision, simple as it seems, has been arrived at only after long and wearisome negotiations. Now it is hoped that, this knotty point once solved, the rebuilding and enlargement of the Charité Hospital will be attacked in earnest. The ground at present occupied by the Koch Institute is required for the hospital, but of course, until the future of the institute itself had been definitely settled, it was impossible to begin work. A new museum for the pathological collections is urgently needed, as Virchow is terribly cramped in the Pathological Institute. It is said that 1896 is to see this

building begun; but delays have been so frequent that it is best not to prophesy.

Nature states that M. Moisson is reported (*Centr. Zeit. für Opt. u. Mech.* xvii. 6) to have discovered a substance harder than the diamond in the form of a compound of carbon and boron, produced by heating boracic acid and carbon in an electric furnace at a temperature of 5,000°. This compound is black and not unlike graphite in appearance, and it appears likely to supersede diamonds for boring rocks, cutting glass and other industrial purposes. It will even cut diamonds without difficulty, and it can be produced in pieces of any required size.

It is reported that the metric system has been legally introduced into Turkey, and that the Russian Minister of Commerce recommended its consideration at the recent Industrial Congress.

It appears from *La Vie Scientifique* that 'La société française de physique' has recently held in Paris an exhibition similar to the recent *Conversations* of the Royal Society and the exhibition of the New York Academy of Sciences. Röntgen photographs, the manufacture of acetylene, applications of aluminum and other recent advances in scientific apparatus were exhibited.

Natural Science states that a summer meeting of the Anatomical Society of Great Britain and Ireland will be held at Oxford on Saturday, July 4th. This Society, which was founded in 1887, meets, as a rule, four times a year, three of the meetings being held at the London medical schools in rotation, and the other at one of the provincial universities or schools.

MACMILLAN & Co. announce 'An Intermediate Course of Practical Physics,' by Prof. Arthur Schuster, F.R.S., and Dr. C. H. Lees.

THE death is announced of the Abbé Delaney, a missionary in China, who discovered and introduced into Europe a large number of undescribed species of plants.

M. GERMAIN SÉE, the eminent French pathologist, has died at Paris at the age of 77.

LIEUT. PEARY will embark from Cape Breton in July, in a steamship under the command of Captain John Bartlett, which will proceed to

Cape York, where Lieutenant Peary last year discovered a meteorite said to be the largest in the world. If the conditions are favorable he may go further north to his former headquarters on Inglefield Gulf. Prof. Ralph S. Tarr with a party from Cornell University will be taken by the steamship to some point in Greenland, where they will remain while the steamship goes further north.

DR. WASHBURN writes to the London *Times* from Constantinople that on Saturday evening, April 18th, at 7 o'clock, as the M. M. steamer Sindh was passing to the south of the island of Cyprus, a brilliant meteor was seen, which appeared to burst just over the island. It seemed to be in all respects an exact duplicate of the meteor which was seen at Madrid several months since. It started about 30° from the zenith, took a direction of about 80° from the horizon, and burst when about 20° from the horizon. For 15 minutes, three zigzag lines of silver light marked its course, and the fiery cloud when it burst did not disappear for half an hour. This appeared to be about 2° in diameter, was very brilliant for some minutes, and then slowly faded. The sight was so startling that those who saw the meteor did not notice the sound of the explosion, but several persons noticed the explosion who did not see the meteor.

THE Hydrographic Office has issued a chart of the Arctic regions prepared under the direction of Commander C. D. Sigsbee. It extends to about 4° south of the Arctic circle, showing the tracts of seventy-six expeditions, and indicating forty-eight explorations of coasts.

A SUMMER session of the New York State Library School, which will take up the elementary principles of library economy, will begin on July 7th and last five weeks.

SIR WILLIAM PRIESTLEY, a well-known physician and writer on medicine, has been elected a member of the British Parliament representing the universities of Edinburgh and St. Andrew.

THE Duke of York has been elected president of the Royal Agricultural Society of Great Britain. The Society has received a bequest of \$50,000 by the will of the late Mr. E. H.

Mills. At the country meeting to be held at Manchester prizes are offered by the Society for self-moving vehicles.

At a meeting of the Philosophical Society of Washington on May 23d the following biographical notices of deceased members were expected: Thomas Antisell, by H. W. Seaman; Stephen Vincent Benet, by Rogers Birnie; J. Mills Browne, by Robert Fletcher; Thomas Lincoln Casey, by B. R. Green; Robert Edward Earll, by G. Brown Goode; William Lee, by D. Webster Prentiss; Walter Lamb Nicholson, by Edward Goodfellow; Orlando Metcalfe Poe, by O. H. Tittman; Charles Valentine Riley, by L. O. Howard; William Bower Taylor, by W. J. Rhees.

THE attention of those who are interested in the history of human progress (it is a pity that we lack the German word *Culturgeschichte*), in its forward and backward currents, should be called to a book of absorbing interest, *Woman Under Monasticism*, by Lina Eckenstein (Macmillan). It gives a vivid picture of the convent life of women during the period between 500 and 1500 A. D., in Germany and England, with special biographies of those nuns and abbesses who exerted an important influence upon the life of their times; but its chief value is in showing that the present effort of women to obtain a greater share of social responsibility is a return to conditions which were the established state of things a thousand years ago. The convent afforded a career for those who felt themselves capable of wider activities than were involved in the care of the household, and a career of greater influence and power than has been open to women, of other than royal descent, under any other circumstances. The closing of the monasteries, by compelling all women to marry, acted injuriously upon human development in more ways than one, even though its effect may have been on the whole desirable. That there is an historical basis for the present movement toward greater independence on the part of women is a matter of much importance.

At a recent meeting of the Anthropological Institute of Great Britain, Professor E. B. Tyler commented upon Mr. Howarth's paper on 'The Asiatic Element of the Tribes of

Southern Mexico,' drawing attention to the difficulty of defining the meaning of the word 'prehistoric' in America. He remarked that the picture writings exhibited by Mr. Howarth were wonderful examples of the authentic Aztec, side by side with the imported Spanish element, the exact proportion of which was, however, exceedingly hard to distinguish. In the United States, he continued, many anthropologists, headed by Dr. Brinton, support a kind of 'Anthropological Monroe Doctrine,' according to which America admitted no extraneous contributions to her culture. The conflict of this theory with the older doctrine gives promise of a good fight in the future, should he still remain constant to the older theory. He found it very difficult, on the new Monroe doctrine, to account for such things as the astronomical calendar. He, nevertheless, favored dropping, for the present, such questions as Egyptian derivation, in favor of the investigation of nearer links in the chain.

It is stated in the daily papers that Profs. Cox and Calendar, of the McGill University have reported to the Canadian Royal Society that they have made experiments showing that the X-rays are deflected by magnetic influence. It is also said that Prof. Dorn and Dr. Brandes, of the University of Halle, have proved that the X-rays affect the retina, it having been demonstrated in the first instance in the case of a patient the lenses of whose eyes had been removed. Later it is said that they were themselves able to see the rays, looking at their source through an aluminum plate.

A COMPLETE edition of the works of Descartes will be published by the French Ministry of Public Instruction, under the auspices of the 'Revue de Métaphysique et de Morale' 5 rue de Mézières, Paris. Five volumes will be devoted to the correspondence, including letters addressed to Descartes as well as those written by him, and five volumes will be devoted to his published works. The publication will be begun this year and will be completed in 1900. A deduction of 40 per cent. in the price will be made to those who send subscriptions in advance to the above address.

WE learn from the *American Geologist* that the

question as to the desirability of retaining the museum of the London Geological Society has formed the subject of long deliberations by the Council of the Society. It was announced at the recent annual meeting that, in accordance with the report of a special committee, the trustees of the British Museum had been asked whether they would undertake to house and care for the collections, keeping type-specimens and specimens illustrative of papers read before the Society distinct, and defraying also the expense of transference. To these conditions the trustees have assented, and the matter will before long be submitted to the Fellows for their decision at a special general meeting.

MR. S. E. DUERDEN contributes to the May number of *Natural Science* an article on 'Museum work in Jamaica,' in the course of which he says that the museum in Jamaica is one of the components of the Institute of Jamaica, an organization existing for the advancement of Literature, Science and Art in the island; and embracing also a well-established public library and reading room and an embryonic art gallery. It is managed by a Board of Governors, and practically the whole support is derived from the Legislature. Members are elected with certain privileges, and members' meetings are held. A journal devoted to the special objects of the institute is published at intervals. Courses of public lectures on science and literature, on the lines of the University Extension courses in England, are arranged from time to time. In almost every department of biological enquiry Jamaica and the West Indies generally offer a very rich but only partially investigated field for research. A vigorous attempt was made a few years ago to form a marine laboratory upon a large scale, with the special object of affording facilities to foreign biologists in studying tropical life, but unfortunately the scheme fell through, largely because of its too ambitious nature. However, a biological laboratory with most modern appliances for carrying on scientific research, and a dark room for photography, have lately been fitted up in connection with the Museum.

THE Congress of Criminal Anthropology to be held at Geneva from the 24th to the 29th of August will meet in five divisions entitled (1)

criminal biology, (2) criminal sociology, (3) criminal psychology, (4) legal applications of criminal anthropology, (5) administrative applications of criminal anthropology. A large number of interesting papers have already been promised, including communications from Mr. Galton, M. Tarde, Prof. Kurella, M. Bertillon, Dr. Brockway and others.

ACCORDING to the authorized announcements of the University of the State of New York in 1888 only five states in the Union exacted an examination for license to practise medicine, and the laws of these States were crude and imperfect and for the most part inoperative. A licensing examination is now required in 22 States. In fact, if we count Texas, whose laws conflict, the roll includes 23. Of these examinations, 16 are before a single board; 4 before 2 boards, allopathic, homeopathic; 3 before 3 boards, allopathic, homeopathic and eclectic. In 11 of these States candidates for examination must be graduates of medical schools; in 3 of these 11 States they must have studied medicine for 4 years; in 2 States they must have attended at least three courses of medical lectures, though a diploma is not required. One of these two States, Minnesota, will require four courses of lectures, but not a diploma after January 1, 1899. In 6 States applicants must have a competent preliminary education, though the provision is indefinite except in the New York law. The laws in 13 States and 3 Territories demand either approval of medical diploma or examination by State or other duly qualified boards. This leaves only New Hampshire, in which not even registration is required, and 8 States and 3 Territories in which it is necessary merely to present the diploma or other certificate of qualification to unqualified local officers. Of the 12 medical schools in New York State, 4 adopted a 4-year graded course in 1894 and 5 in 1895 and 1896. For matriculants after January 1, 1898, four years study of at least nine months each, including four satisfactory courses of at least six months each in four different calendar years must be required for degrees by all medical schools in New York State. This minimum standard for the degrees of M. D. is equal to that prescribed in Austro-Hungary, France and Germany.

UNIVERSITY AND EDUCATIONAL NEWS.

THE Woman's Educational Association of Boston proposes to institute scholarships in summer schools for Boston school teachers, and urges women's clubs and other organizations of women interested in public-school work to establish similar scholarships, or to select at least one of their young teachers who shall be sent to a summer course. A list of eight of the chief colleges and universities offering such courses is added. During the summer of 1896 the scholarships of the Boston Association will be chiefly offered for the course in physical geography at Harvard University. The amount of money now at the disposal of the Association being small, the committee asks that contributions toward this object be sent to Mrs. R. H. Richards, Institute of Technology, Boston.

THE board of regents of the University of Wisconsin has recently made the following promotions in the faculty of that institution: Louis W. Austin, Ph. D., from instructor in physics to assistant professor in physics; Lellen S. Cheney, B. S., from instructor in general and pharmaceutical botany to assistant professor of pharmaceutical botany; Wm. S. Marshall, Ph. D., from instructor in biology to assistant professor of zoölogy; Wm. A. Scott, Ph. D., from associate professor of political economy to professor of economic history and theory. Frank C. Sharp, Ph. D., from instructor in philosophy to assistant professor of philosophy; Rodney H. True, Ph. D., from instructor in pharmacognosy to assistant professor of pharmacognosy.

THE Connecticut Dental Association has voted to petition the Yale corporation for the establishment of a dental school at Yale University.

DR. ROBERT G. REMSEN, JR., of the Class of '73, has given the New York University \$3,000 toward the endowment of scholarships.

THE University of Glasgow has received £8,000 by the will of the late Dr. John Grieve, the money to be used for the foundation of a lectureship or fellowship.

THE following foreign appointments are announced: Dr. Ludwig Katheriner, professor of zoölogy and comparative anatomy in Frei-

burg, Switzerland; Mr. James G. Lawn, professor of mining at the South African School of Mines, Cape Town and Dr. Otto Fischer, associate professor of physiological physics at Leipzig.

DISCUSSION AND CORRESPONDENCE.

A REVIEW OF BIGELOW'S PAPERS ON METEOROLOGY AND SOLAR PHYSICS.

ABOUT a year ago the writer was so struck upon reading a paper* on the 'Inversion of Temperatures in the 26.28 Day Solar Magnetic Period' that he was led to look a second time at a previous paper by the same author, viz., a 'Report on the Relations of Solar Magnetism to Terrestrial Magnetism and Meteorology.'† A severe estimate of these papers induced the writer to study carefully such others‡ of Prof. Bigelow's papers as have been accessible. The result is that the writer has reached a trenchant conviction that Prof. Bigelow's theories are peculiarly and wildly vagarious and that his results are meaningless. A more recent paper‡

* By Frank H. Bigelow, Professor of Meteorology, U. S. Weather Bureau. *Am. Jour. Sci.* (3), 48, p. 435.

† Report for 1891-2 of the Chief of the U. S. Weather Bureau, p. 519.

‡ Notes on a new method for the discussion of magnetic observations. By FRANK H. BIGELOW. *Bulletin No. 2*, U. S. Weather Bureau.

The polar radiation from the sun. By FRANK H. BIGELOW. *Astron. and Astro-Physics.* 13. p. 26.

The two magnetic fields surrounding the sun. By FRANK H. BIGELOW. *Astron. and Astro-Physics.* October, 1893.

Further study of the corona. By FRANK H. BIGELOW. *Am. Jour. Sci.* 3, 40. p. 343.

The Solar corona, an instance of the Newtonian potential function in the case of repulsion. By FRANK H. BIGELOW. *Am. Jour. Sci.* 3, 42. p. 1.

Note on the causes of the variations of the magnetic needle. By FRANK H. BIGELOW. *Am. Jour. Sci.* 3, 42. p. 253.

The solar corona discussed by spherical harmonics. By FRANK H. BIGELOW. *Smithsonian Institution*, 1889.

Bulletin No. 13, of the U. S. Scientific Expedition to West Africa, May, 1890.

‡ *The Earth as a magnetic shell.* By FRANK H. BIGELOW. *Am. Jour. Sci.* 3, 50. p. 81.

proves, upon examination, to be, again, mere iterate nonsense.

The writer is old-fashioned enough to believe that a plain person can, with some pains at least, understand the writing even of a specialist, and he is driven by a sense of sheer outrage to criticise these writings of Prof. Bigelow; not, indeed, without peculiar hesitation, for to criticise is to point out fallacy, but there is nothing such in these papers; they are too inane to be fallacious! Let the reader bear in mind that the writer's estimate of these papers has been reached only after studious and repeated reading of more than one hundred thousand such words as are sampled in the following quotations.

Speaking of the previous efforts in systematic meteorology Prof. Bigelow says: "The best efforts have been made along the lines of Thermodynamics as the moving cause and dynamical mechanics as the procession of effects; much talent, if not genius, having been expended on these mathematical and physical relations."*

Prof. Bigelow has devised a method for determining the synodic period of rotation of the sun. This method, so far as the writer can understand it, is Gauss's well-known method, in which a time interval is determined during which an unknown whole number and a known fraction of periods have elapsed; the whole number is found by dividing the interval by a known approximate value of the period; the exact period is then easily calculated. To obtain the data for this determination Prof. Bigelow claims definitely † to have made use of the aspects of the solar corona as photographed during several total eclipses, the corona being assumed to rotate with the sun and to present persistent peculiarities of form.

He goes on to say: "It is impossible to reproduce fully the process of obtaining this period, because the work is extensive; but it is so important, being the key to my development of the subject, that I will briefly indicate the method. If the sun is a magnetic sphere in

which the magnetism is distributed with irregular intensity throughout the mass, in the same way that the permanent magnetism of the earth deviates from the simple law of the uniform spherical magnet, then in the field outside the sun, as far as its strength reaches into space, the lines of force being propagated through the ether, these variations of intensity will be found by an observer passing along it from point to point."* He adds that if this field reaches the earth it will change as the sun rotates and can be 'measured with almost incredible accuracy;' but we gain no clue to the method which must be some other than Gauss's method, after all, unless indeed the terrestrial magnetic elements have such a distinct fluctuation in the solar-rotation period as to enable an observer to infer the recurrence of solar rotations thereby, which Prof. Bigelow does not state explicitly; but the 26-day variation of the terrestrial magnetic elements is only brought out by averaging magnetic data at corresponding epochs in a large number of successive solar-rotation periods, and then only with great uncertainty. Prof. Bigelow does not seem to bear it clearly in mind that he has used the corona in determining this period.

Prof. Bigelow imagines three cosmical magnetic fields at the earth, viz: the 'coronal field,' perpendicular to the ecliptic due to the action of the sun as a great magnet; the 'radiant field,' in the direction of the sun's rays, and the 'orbital field,' in the direction of the earth's motion in its orbit. Speaking of the coronal field Prof. Bigelow says: "This field enters the northern hemisphere nearly parallel to the earth's axis of rotation, having been diverted from the direction perpendicular to the plane of the ecliptic by the rotation of the earth on its axis, the other component having been screened off or used up in connection with the earth's permanent magnetism, which may be the true origin of the force which gives it a slow secular variation.† At this place we interpose the remark that the position is regarded as proven that the sun and the moon do not continuously

* Report for 1891-2 of the Chief of the U. S. Weather Bureau, p. 519.

† See p. 521 report for 1891-2 of the Chief of the U. S. Weather Bureau.

* Report for 1892-2 of the Chief of the U. S. Weather Bureau, p. 521.

† Report for 1891-92, of the Chief of the U. S. Weather Bureau, p. 522.

influence the terrestrial field by direct action as magnets."*

The coronal field is referred by Prof. Bigelow to the action of the sun as a great magnet; at least, while convincing himself of its existence in his earlier papers, he assumes it to be due to this action; but after reaching this conviction he appears to think it no longer necessary for the field to have a physical cause.

"The solar magnetic field represents a type of radiant energy, probably circular or spiral rotation of the ether which surrounds the sun on all sides, but of variable strength in certain solar longitudes. In other words, the earth passes through a series of hotter and cooler regions as the sun turns on its axis. One day is the equivalent of about 10,000,000 miles. Since the form of energy is magnetic, which, of course, means a special form of ether motion, this energy approaching the earth, itself a magnetic body capable of conducting the lines of force better in some directions than in others, is concentrated or focussed in the magnetic ovals surrounding the magnetic and geographical poles. The form of the regions of concentration came out fully in my study of the equatorial radiant field. Thus the atmosphere around the polar regions is intermittently heated or cooled, according as more or less of this polar energy falls upon it, the temperature being a direct function of the radiant energy."†

The idea that vortex motion of the ether constitutes magnetic field is, as yet, mere speculative theory‡ intensely interesting, coming from such masters as Lord Kelvin and Clerk Maxwell; supremely foolish, coming from one who, for example, uses the word 'spiral' in speaking of it, or from one who thinks a magnetic field to be a stream of energy!

"As already described, besides the coronal field perpendicular to the plane of the ecliptic near the earth, there is another field, in the plane of the ecliptic, called the radiant field, agreeing with the direction of the ether energy of light and heat emitted from the sun. It originates in the electric discharges between the atoms of the photosphere, is electro-magnetic, is propagated with the velocity of light, and in the atmosphere of the earth and in the earth itself undergoes a complex series of transformations of energy, by which the short, rapid waves are lengthened

or destroyed, the work thus used up appearing in transformations of physical phenomena."*

"The finally constructed field surrounding the earth is exceedingly complex, and a description of it here is quite impossible, though some of the leading features of it may be mentioned. The fundamental law of the entry and departure of the forces from the earth conforms to the tangent law of magnetic refraction, the index being about 1.25. In the northern hemisphere the field (Radiant Field) points towards the sun, in the southern away from the sun, so that the earth is in a magnetic couple, the radiant field showing a potential fall from the sun outwards. The plane of symmetry of the field is not on the meridian of the sun, but is thrown westward by the rotation of the earth, through an angle of about 23° in the northern and 15° in the southern hemisphere. The field shows a series of five parts, gradually changing within their areas, but discontinuous as to each other. These are the polar field, the north mid-latitude field, the equatorial field, the south mid-latitude field, and the south polar field. The polar field is three or four times as strong as the others, in which the forces concentrate in two polar points and act along the meridians; the northern field points across the meridians, the discontinuity being along the belt of the auroral maximum of frequency; the equatorial field points north or south, and the southern field across the meridians, away from the sun. The strength of the radiant field is about 0.000135 c. g. s., being a little greater than the coronal field. A complete discussion of the numerous physical problems arising from these facts cannot now be attempted, but great light is thrown upon many of the observed physical phenomena that have been perplexing to scientific research. It seems especially to confirm in a marked degree the theory of Maxwell regarding the electro-magnetic constitution of the radiant ether waves."† "The surprising identification of magnetic and light action of the radiations of the sun in direction will be recognized as harmonizing with the conclusions arrived at by Maxwell and Hertz in their investigations."‡

Now, the magnetic field in light and heat waves is at right angles to the ray and is reversed in *direction* millions of millions of times per second! It is to be noticed that Prof. Bige-

* Report for 1891-92, of Chief of Weather Bureau, p. 254.

† Report for 1891-92, of the Chief of the Weather Bureau, pp. 524-525.

‡ This is verbatim quotation. The reference has been lost among the mass of the writer's notes, and cannot be recovered with reasonable labor.

* Bulletin No. 2, U. S. Weather Bureau, pp. 7-8.

† Astron. and Astro-Phys., 13, p. 37.

‡ Compare Prof. Oliver Lodge, London Electrician, Jan. 18, 1895, p. 332.

low considers the 'coronal' field to be a stream of energy. If such is the case it is of course not a magnetic field, but he surely so considers it and has determined its strength C. G. S! as he has also determined the strength of the 'Radiant' field and of the 'Orbital' field!

Forgetting the essential character of his corona Prof. Bigelow, in a recent paper,* 'adopting J. J. Thomson's language,' scrambles wildly after a conception of the sun's corona as a stream of matter.

"It should be noticed that there may be found in this polar radiation the true cause of the great changes of temperature in the polar regions, known in the glacial epoch."† "It is hoped that the developments of the case may not lead to any permanent difficulties that cannot be overcome, for the following reason: In a final analysis it appears that all these phenomena are to be referred to Newton's Law."‡

The passages here quoted from Prof. Bigelow's papers do not suffer by extraction from the context. Very few passages are specific enough to be quoted to any purpose whatever, and it is this fact which has governed the present choice. The paragraph referring to 'a diagram of magnetic centers,' page 523 of the Report for 1881-2 of the Chief of the United States Weather Bureau, is a fair sample of the involved vacancy of Prof. Bigelow's style. Yet curiously enough, *being entirely devoid of conceptions*, it at first strikes one merely as something one does not understand.

"In two papers§ already published, a brief statement has been presented of the lines of evidence that tend to prove the following facts: 1. That the sun emits two distinct types of radiant energy into the space outside of its surface. 2. That the first is propagated radially in all directions, the part falling upon the earth, especially on its equatorial belt, being an electro-magnetic wave, whose electro-motive force

$$\int (Xu + Yv + Zw) d\tau, ||$$

* See Am. Jour. Sci., 3, 50, p. 83.

† Astron. and Astro-Phys., 13, p. 39.

‡ Bulletin No. 2, U. S. Weather Bureau, p. 9.

§ American Meteorological Journal, Sept., 1893, Astron. and Astro-Phys., Oct., 1893 (Prof. Bigelow's Reference).

|| No reference whatever to the significance of the symbols nor to the source of the expressions.

by the law of the conservation of energy, breaks up into the dynamic wave

$$\int \left(u \frac{dF}{dt} + v \frac{dG}{dt} + w \frac{dH}{dt} \right) d\tau$$

partly inductive and partly magnetic in its instantaneous state, plus the static or potential stress.

$$\int \left(u \frac{d\psi}{dx} + v \frac{d\psi}{dy} + w \frac{d\psi}{dz} \right) d\tau$$

plus the irreversible energy of Joules' (*sic.*) heat

$$\int \frac{u^2 + v^2 + w^2}{C} d\tau, \text{''''}$$

The mathematical discussion in this paper (Astron. and Astro-Phys. 13, p. 26) begins and ends with this quotation. It is in no way a conclusion to anything gone before, nor the beginning of anything to be finished afterwards. As to what it really is, the writer's opinion is already sufficiently expressed. Those who can recognize the bricks in it will have no difficulty in judging for themselves. A passage of the same character occurs pp. 95-96, Vol. 50, Am. Jour. Sci. :

"The real order of events in Nature may, however, be summarized as follows: The Equatorial Field generates a tropical high pressure, and a sub-polar low pressure belt, by its distribution of temperature. The continents rearrange these belts so that in winter the small polar circuit surrounding the Icelandic permanent low supersedes and predominates, while in summer the great midlatitude circuit regains its supremacy. Therefore in winter the circulation of the polar circuit is more rapid; being smaller in diameter, the supply comes across the North American polar regions, and but little from the Pacific; in summer the slower eastward march in the wider circuit sets in, with the supply from the Pacific. In both cases the movement of the air masses is dominated by the varying intensities of the polar magnetic field from the sun, by which the densities of the contents of the unit volume is changed. High pressure areas are the primary products of these sources of energy, being in part whirled up by the general circulation, and in part the result of reducing the polar absorption by diminution of the cosmical energy on certain dates.†

This is not so distinctly articulate nonsense, by far, as are the more theoretical parts of Prof. Bigelow's papers, for there *is* such a thing

* Astron. and Astro-Phys. 13, p. 26.

† Am. Jour. Sci., 348, p. 449.

as a high or a low pressure area, such a place as the North American polar region and a Pacific Ocean.

The reader will find sets of curves* showing such coincidences as Prof. Bigelow thinks to have discovered between certain periodic phenomena of terrestrial magnetism and certain periodic meteorological phenomena. The writer is unable to give any definite help towards a clear understanding of these curves, indeed, "A complete exposition of the data is impossible in this connection, and therefore no values are assigned to the ordinates of the several curves."†

In conclusion, let it be said that the writer has had occasion to examine irrational writing before, but he has never encountered such froth till now. The more excusable nonsense, and often the more evident, is that which is built, it may be with care, upon false conceptions; but these papers of Prof. Bigelow's are devoid of all conceptions, and at best they are mere pretension.

The writer begs the reader's indulgence in what may seem to be undue severity in this, to the writer, questionable business; but having been vexed with it for more than a year, between the difficulty of bringing it to an end, on the one hand, and the impossibility of putting it aside, on the other, he is now chiefly anxious to be done with it, and is inclined to give, with a minimum of argument and example, the plainest and sternest statement of fact.

W. S. FRANKLIN.

IOWA STATE COLLEGE.

DR. BRINTON ON KEANE'S 'ETHNOLOGY.'

TO THE EDITOR OF SCIENCE: IN SCIENCE, March 20th, Dr. Brinton has a notice of my *Ethnology*, which is so manifestly unfair that I will ask you to allow me a little space for a brief reply. The 'title is an error,' because I take ethnology to be 'nearly synonymous with anthropology as employed in modern science.' On the contrary, I carefully distinguish between

general anthropology, which, of course, covers 'all branches of knowledge whose subject is man,' and *special* anthropology, to which ethnology is 'complimentary' (pp. 1-2). Dr. Brinton does not call attention to these distinctions, thus leaving himself convenient scope to quibble and misrepresent.

My theory of races 'is a modern recast of that of Blumenbach.' Not so; on this point I reject Blumenbach and state in the clearest language that 'Linné's original fourfold division must be upheld' (p. 222). Blumenbach's Malayan race is 'explained away as partly Ethiopic, partly Caucasian.' Rejecting Blumenbach's five divisions, I had no occasion to 'explain away' his 'Malayan race.' Nor do I represent this race as 'partly Ethiopic, partly Caucasian,' but 'distinctly Mongoloid, one might almost say Mongolic without reservation' (330).

I refer to opponents as 'eccentric or reckless or extravagant.' These epithets are used sparingly and never personally, but only in reference to strange or impossible theories, such as: 'evolution with a jump' (p. 235), and the like.

I 'do not hesitate to strain a point to defend his [my] opinion,' and Virchow on the Neanderthal skull is given as a proof. Here the point is strained, not by me, but by Dr. Brinton, who omits Virchow's last word on the subject, which is that he never maintained 'the *absolutely* pathological character of the skull' (p. 424). This, no doubt, leaves Dr. Brinton *im Stiche*, but that is no reason why he should bring false charges against me.

I claim 'as original' to myself, amongst other theories, 'the relationship of Basques and Berbers.' No! what I claim as original is my 'general treatment of * * * the Ibero-Berber question' (xv.), which Dr. Brinton knows is quite a different thing.

"The relationship of the members of the various races is shown by 'family trees,' an ancient and misleading device." These trees are not 'ancient;' they are mine; or will Dr. Brinton tell us where else he has seen them? But they are 'necessarily misleading;' yes, if the accompanying text be overlooked, and the branches wilfully entangled, and then notes of exclamation added as thus: "The Teutons and Slavs are on a different branch!" The Teutons and

* Report for 1891-2, of the Chief of the Weather Bureau, plate IV., Am. Jour. Sci., 3, 48, p. 448.

† Report for 1891-92, of Chief of the Weather Bureau, p. 525.

Slavs are on *two* different branches!! Again, "The Kolosch and Selish are depicted as proceeding from the Eskimo!" I write Kolushan Salishan, plainly showing, as explained in the text (p. 360) that I mean these to be taken as *stocks* (notsecondary groups), in accordance with Mr. Powell's 'convenient plan.' But Dr. Brinton suppresses the final *an* and is thus able to hold me up to ridicule by the long discredited *suppressio-veri-et-suggestio-falsi* argument.

"The chapter on the American race is replete with positive assertions, nearly always unsupported; for instance, 'the alleged impassiveness of the native character.' " Well, I devote five pages (353-357) to that subject, and support my contention by the authority of Pastor Egede, Reclus, Catlin, J. P. Dunn, Jr., Humboldt, E. F. Knight, E. im Thurn and Darwin!! So it is Dr. Brinton's charge that is 'unsupported.'

I refer to 'a highly respected American writer, as Mr. Thomas Cyrus (p. 370).' Yes, but Dr. Brinton forgot to tell his readers that this was the merest slip, as clearly shown by the correct references to that excellent authority at p. 107, p. 343 and in the index.

But "it is obvious that the author has not consulted the best and most recent studies in American aboriginal ethnography." How can this be when Dr. Brinton tells another circle of readers (Dr. Brinton spreads himself considerably) that my work is "scarcely more than an expansion of the one referred to, pursuing the same plan, treating the same subjects in nearly the same order, and in various portions advancing as his own the opinions set forth by that referred to, to wit: 'Races and Peoples, Lectures on the Science of Ethnography, by D. G. Brinton, New York, 1890' (*American Anthropologist*, March, 1896, p. 100). If, I say, my ethnology is scarcely more than an expansion of a book by Dr. Brinton, how can he now truthfully say that I have 'not consulted the best, etc.,' on the subject? Or has the sage of Philadelphia such a poor opinion of his own compilations as to regard them as 'the worst, etc.?' I may incidentally add that this disgraceful charge of wholesale plagiarism is as baseless as all of Dr. Brinton's other charges. His *Races and Peoples* was never once consulted

by me on any single point, and at the present moment I have but the haziest recollection of its contents, even giving it an incorrect title in the reference made to it from a treacherous memory in the preface, p. vii.

Dr. Brinton again refers to my 'theory of the Malayan race,' which should be my theory of the 'Interoceanic Races,' of which the Malayan is but one. This theory, he writes, "we may allow is at present, and is likely to be his [my] own peculiar property." This is hitting me below the belt with a vengeance, for Dr. Brinton, who knows everything, knows quite well that the theory in question, first brought by me before the British Association in 1879, has since been accepted in its essential features both by Dr. Hamy and de Quatrefages, two of the most distinguished French anthropologists of our times.

Dr. Brinton, however, is gracious enough to make one concession. He is willing to allow that one particular chapter 'might have been much more uninstrusive.' To be sure, this may be 'meant sarcastic,' or may even be regarded by some as a choice specimen of concentrated malevolence. In any case, it is not much for a book which I am able to inform Dr. Brinton has been received with acclamation in England, which has been spoken well of in the far West (*American Journal of Sociology*, Chicago, March, 1896), and which has been accepted on the continent as *le meilleur traité d'ethnologie que nous possédions jus qu'à présent* (*Rev. Bibliographie*, Feb., 1896, p. 100).

With this I may confidently leave 'this fellow here with envious carping tongue' (Shakespeare) to the judgment of your American readers.

A. H. KEANE.

ARÂM GÁH, 79 BROADHURST GARDENS,
LONDON, N. W., April 22, 1896.

I CLOSED my notice in the *American Anthropologist* of Mr. Keane's work with an expression of regret at the discourteous language he uses toward those with whom he disagrees. If other evidence were lacking to prove the justice of my remark, it would be supplied by the above letter. So abusive was that sent by Mr. Keane to the *Anthropologist*, in reference to my notice, that the editor felt constrained to omit

some of its adjectives, and supply their position by blank spaces!

In the *Anthropologist* I asserted that in his so-called 'Ethnology' Mr. Keane 'pursues the same plan, treating the same subjects in nearly the same order' as I did in my 'Races and Peoples,' published six years ago. Mr. Keane now professes to have 'but the haziest recollection' of the contents of that book (though in his note in the *Anthropologist* he acknowledges to have read it). Its very title he had quite forgotten! His 'treacherous memory' led him to mention it under quite a different name from the one it bears! How, then, 'can he truthfully say' (to quote his words) that the scheme of his book has *not* the singular similarity I noted to that of my own? He is convicted out of his own mouth of denying the charge I made, without pretending to ascertain whether it is true! I challenge comparison of the books by readers not disabled by a morbid self-esteem from deciding correctly. I challenge the production of any other work on this science, published in any language, since 1889, so obviously akin in plan and treatment to my 'Races and Peoples,' as is Keane's 'Ethnology.' I am quite willing to allow Mr. Keane the plea of 'unconscious memory;' but the facts speak for themselves.

Mr. Keane makes the assertion that I brought a 'false charge' against him in reference to Virchow's opinion about the Neanderthal skull. He quoted Virchow as stating that the skull was 'possibly pathological.' I quoted Virchow's own words, giving them in the original German, that he had offered 'the positive proof' that it was pathological. The 'false' statement is unquestionably Mr. Keane's; but then he suffers from such a 'treacherous memory!'

Mr. Keane seems much disturbed at my statement that he had not consulted the best and most recent studies on American aboriginal ethnography. In reply, he makes no pretence that he did so, but follows the legal precept, 'When you have no defence, abuse the opposite counsel.' I turn to his index and look in vain for the names of Adam, Bandelier, Ehrenreich, Leon, Middendorf, Quevedo, Seler, Steinen and many others, without a knowledge of whose

excellent labors it is presumptuous in a writer to pretend to any but a second-hand and superficial knowledge of American ethnography.

It is needless to occupy more space with such a discussion. I reiterate the justice of my criticisms on Mr. Keane's book; and as a set off to his report of the 'acclamation' with which, he informs us, it has been accepted in England, I add that I have received letters from several prominent anthropologists in the United States telling me that I had dealt with its errors and crudities much too leniently.

D. G. BRINTON.

UNIVERSITY OF PENNSYLVANIA.

TO PREVENT THE GROWTH OF BEARD.

IN March last, Dr. B. F. Egeling, of Monterey, Mexico, sent to the Department of Agriculture several specimens of the cocoons of a large Bombycid moth, with the statement that these cocoons are worn by the natives around the neck and are believed to prevent the growth of beard on the chin. Dr. Egeling wished to know the name of the species. Specific determination was impossible from the cocoons alone, but on May 18th a fine female specimen of one of the handsomest of the Central American Attacine moths issued and proved to be *Attacus jorella*, of Westwood, described in the Proceedings of the Zoölogical Society of London, 1853, pp. 150-160, and figured at Plate XXXII., Fig. 1. The locality given by Westwood is Cuantla, Mexico, and the statement is made that the type specimens were reared in August from cocoons spun the previous October. The use to which the cocoons are said to be put by the natives is new to the writer. Perhaps it has been recorded by some collector of facts of this nature.

L. O. HOWARD.

THE CHILD AND CHILDHOOD IN FOLK-THOUGHT.

TO THE EDITOR OF SCIENCE: The author of 'The Child and Childhood in Folk-thought' has no desire to enter the lists on behalf of his book, being willing to have its fate decided by those to whom it has appealed and for whom it was written. But against the general dogmatic tone of the reviewer (SCIENCE, N. S. Vol. III., No. 72) he ventures a mild protest. Hardly does the present state of the science justify the

cocksureness there displayed, nor is the reviewer vindicated in his certainty that the author intended to force a 'psychological connection' here, or ought to have made out one there. If Dr. Boas, remembering that all writers have not reached that eminence of synthesis and systematization on which he so conspicuously dwells, will once more peruse the volume he will discover that neither in its claims nor in its execution does it traverse those sound principles of the comparative method of which a peculiar interpretation belongs to him. In these the writer believes as thoroughly as does the reviewer. But, as to the exact manner and method of determining where a 'psychological connection' exists, or what phenomena are 'derived psychologically or historically from common causes,' a great deal of reasonable difference in opinion exists, and this the author has not ignored. The reviewer has throughout attributed to the writer a much more ambitious thesis than he really attempted, and has apparently seen efforts at connection and comparison where none such existed or were thought of. That the author has completed the task he set himself, other reviewers have perceived and acknowledged; to have accomplished the task the reviewer sets him, he had needs be the reviewer himself.

ALEX. F. CHAMBERLAIN.

WORCESTER, MASS., May 15, 1896.

'THAT GREAT LAW OF LOGIC.'

IN a recent number of this JOURNAL (p. 668 above) I ventured to criticise Professor Brooks for using ambiguously the phrase 'test of truth,' and for not appreciating the force of a letter by M. M., calling attention to this. I then pointed out what seemed to me an analogous confusion in regard to the material and the efficient causes of evolution, saying that I did this at the risk of being accused of irrelevancy by Professor Brooks. I did not at all intend to include Professor Brooks with those who have confused material and efficient causes, and his reply (p. 779 above) should have been directed to Professor Cunningham who in the May number of *Natural Science* makes, I think incorrectly, this charge.

Professor Brooks is mistaken in saying that I

did not specify anyone who seems to me to use the word 'cause' ambiguously. It is, indeed, easy to adduce other eminent naturalists in addition to the one to whom I referred. Thus Professor Weismann writes in his most recent paper (*On Germinal Selection*, authorized translation: Chicago, 1896): "The protective coloring * * * * arose not because it was a constitutional necessity of the animal's organism that here a red and there a white, black, or yellow spot should be produced, but because it was advantageous, because it was necessary for the animal." Weismann's state of mind seems to be similar to that of the little boy who was watching at a hole for a woodchuck to come out, and when asked how he knew there was a woodchuck in the hole said "because we have company for dinner and there is no meat in the house."

While Professor Brooks replies to a question in which we agree he neither defends nor retracts the statement which I think is guilty of an analogous blunder, and it seems as though he does not appreciate the point raised by M. M. It is, perhaps, merely a matter of words, but when words are used ambiguously arguments become fallacious. When Professor Brooks writes advocating "that great law of logic, 'the test of truth is evidence and not conceivability,'" does he mean to deny that conceivability is a sufficient proof of truth or to deny that conceivability is a necessary condition of truth, and what does he mean by conceivability?

In the curious history of thought we have had inconceivability urged as a proof of truth, but not, so far as I am aware, conceivability; no one holds that the situations in the modern realistic novel have occurred because they are conceivable. It has, however, been claimed that conceivability is a necessary condition of truth, and by one who holds this position (as Mr. Herbert Spencer) Professor Brooks' statement could neither be affirmed nor denied any more than he could answer yes or no to the question "Did you hold the lantern when your father robbed the stagecoach?"

Then Professor Brooks' 'great law of logic' is doubly illogical because he also uses the word 'conceivability' ambiguously. When he writes

that he 'cannot conceive of the antipodes' he uses the word differently from Huxley in the sentences he quotes, for Huxley only says that he believes that something will be accomplished, though he cannot conceive how. It happens that J. S. Mill uses Professor Brooks' example to explain the proper use of the word, writing (*Logic*, II., p. 321): "Antipodes were really, not fictitiously, inconceivable to our ancestors: they are, indeed, conceivable to us." Everyone will agree that conceivability in Professor Brooks' sense is not a necessary condition of truth, but this does not concern his subsequent argument.

Professor Brooks states in his last letter that Aristotle held "that our business in this world is to learn all we can of the *order* of nature, leaving to more lofty minds the attempt to find out what it is that 'produces anything and makes it what it is.'" Yet very curiously in his previous article to which he refers (*SCIENCE* N. S., Vol. I., p. 126) he wrote: "I should like to see hung on the walls of every laboratory * * * the older teaching of the Father of Zoölogy [Aristotle] that the essence of a living thing is not what it is made of, nor what it does, but why it does it." Professor Brooks seems to have proceeded from the *ignoramus* of his preceding paper to *ignorabimus* now, but he is not justified in taking Aristotle with him.

J. McKEEN CATTELL.

COLUMBIA UNIVERSITY.

SCIENTIFIC LITERATURE.

A Text-book of Gas Manufacture for Students:

By JOHN HORNBY, F. S. C. 12mo, pp. 261; 6 plates. London, 1896, Bell & Sons. New York, Macmillan & Co., 66 Fifth Ave. \$1.50.

A concise little book setting forth the chief points in gas manufacture in a manner that students can readily grasp has been a desideratum. The manufacture of coal gas, with its attendant by-products, is very extensively developed in England; hence to that country we look for excellent treatises on this subject, and this 'Text-book' meets the requirements.

After a short consideration of the properties and value of various coals for gas making, the author discusses carbonization; the construction

and setting of retorts and furnaces; the various appliances usually found in the retort house; the effect of temperature on the quantity and quality of the gas and on the by-products; condensation of tar; removal of ammonia and the elimination of other impurities; methods of testing purity and illuminating power; the various problems incidental to the distribution of gas to the consumers, and the construction of meters and burners. In Chap. XX., on the Composition of Coal Gas, is shown the effect of the various components of gas on its illuminating power.

The American reader will notice the slight attention given to water gas. Very little of this is used in England, it having been developed within the last fifteen years, while in most cases the English coal-gas works, with their plants for saving by-products, have been established much longer. A short description of the Lowe process, together with a plate, is given.

The author divides the water-gas process into 'continuous,' in which the reaction between carbon and steam takes place in an externally heated retort, and 'intermittent,' in which the carbon is raised to incandescence by an air blast, and then steam is blown into the hot mass. He adds that the continuous process has not proved a success. But in this country the term 'continuous' is applied to those processes in which a non-luminous water gas is made in a generator and stored in a gasometer, being afterwards carburetted in externally heated retorts. Processes of this character, notably that of Wilkinson, have proved very successful here for large works.

A short description of Peeble's gas-enriching process is followed by a chapter on sulphate of ammonia, which closes the book.

The print and plates are excellent and the illustrations are generally good, excepting two indistinct views of mechanical charging and drawing apparatus. FRANK H. THORP.

Repetitorium der Chemie: DR. CARL ARNOLD, Professor der Chemie an der Königl. Tierärztlichen Hochschule zu Hannover. Siebente Auflage, Verlag von Leopold Voss, Hamburg und Leipzig. 1896.

This octavo-volume contains six hundred and six pages, of which three hundred and forty-six are devoted to organic chemistry and the remainder to inorganic chemistry. Concise and correct statements regarding the more important data of the various elements and their derivatives are given. No fault can be found with the matter presented. One is impressed with the fact that the most recent chemical literature has been carefully gleaned. It is stated in the preface that when preparing this book the author had mainly in view the needs of medical and pharmaceutical students, and the impression made upon the reviewer, after careful examination of the text, inclines him to the opinion that Prof. Arnold has truly succeeded in making a valuable 'quiz compend' for a class of students who study chemistry chiefly as a side issue. The typography and binding are well executed.

S.

*SCIENTIFIC JOURNALS.**AMERICAN JOURNAL OF SCIENCE.*

THE June number opens with an article by M. Carey Lea, 'On the Color Relations of Atoms, Ions and Molecules.' This is the second part of an investigation, the earlier results of which were published in the *Journal* for May, 1895. In the present paper the author discusses first the interaction of ions. It is shown that if a colored substance be formed by the union of a colorless kation with a colorless anion, the color belongs to the molecule only. The colorless ions have so modified each other's vibration periods that selective absorption is exercised. As soon, therefore, as the molecule is divided into ions the color must disappear. Consequently a solvent which is capable of separating the ions gives a solution, which when dilute must be colorless, no matter how intense the color of the compound. This is illustrated by the case of the highly colored Sb_2S_3 , which forms colorless solutions because the ions, antimony and sulphur are colorless.

Furthermore, in regard to the combination of ions, it is shown that two or more similar colorless ions may unite to form colored elementary molecules; on the other hand, if colored, they

may unite to form a colorless or white molecule or polymer; or to form a molecule of a wholly different color, as when blue copper ions unite to form red copper. Still, again, two or more dissimilar colorless ions may unite to form a colored molecule, as sulphur and silver to form black silver sulphide. The use of acid indicators, for example, of litmus, is discussed, and it is shown that the change of color on contact with an alkali in no way depends upon dissociation.

The relation of the subject in general to the classification of the elements is taken up and extended beyond the point where it was carried in the earlier memoir. The failure in certain cases of Mendeléeef's periodic law is remarked upon and it is shown that the relation of ions to the visual rays leads to a classification which is in complete harmony with the chemical characteristics of the elements.

C. C. Hutchins and F. C. Robinson have a paper on the making and use of Crookes tubes to be employed in studying the phenomena connected with the Röntgen rays. The authors show that, with suitable choice of material and some skill in glass-blowing, tubes of the most favorable form may be made and exhausted in the laboratory. They have repeatedly made one, exhausted it and used it, all within an hour's time. The particular form of the tube, and the shape and distribution of the electrodes which are most favorable for producing a rapid result are discussed. It is stated that excellent impressions of the bones of the hand through thin sheet zinc have been obtained in two minutes. Incidentally some suggestions are given in regard to the best method of pumping in order to produce the high degree of exhaustion called for.

A. M. Mayer gives the results of researches on the Röntgen rays. He shows, in the first place, that they cannot be polarized by being passed through herapathite, or the iodo-sulphate of quinine, discovered by Herapath. The details of the experiments leading to these results are given, and incidentally the density of the material was found to be 1.557. In studying the transmission of the rays through certain materials the following results have been obtained, taking the amount of transmission

through aluminum of one-tenth of a millimeter and one millimeter respectively, as unity :

	$t = \frac{1}{10}^{\text{mm.}}$	$t = 1^{\text{mm.}}$
Aluminum.....	1.	1.
Glass	1.016	1.180
Green tourmaline.....	1.016	1.180
Herapathite	1.036	1.435
Platinum.....	0.000696	

Finally, it is shown that the actinic effect of the Röntgen rays varies inversely as the square of the distance of the sensitive plate from the radiant source.

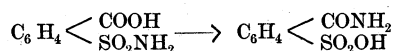
George I. Adams gives an extended memoir on the 'Extinct Felidæ of North America.' In this the literature of the subject is summarized; new points are added in regard to the family in general, with the description of certain typical species, particularly of *Hoplophonus primævus*, and finally the paper closes with a new classification intended to avoid the difficulties involved in those given hitherto. The paper is accompanied by three plates.

Arnold Hague discusses the age of the Igneous rocks of the Yellowstone National Park, the study by Knowlton of the flora found in a number of localities having made it possible to arrive at definite conclusions. The author remarks that "the facts brought together here clearly demonstrate that the pouring out of igneous rocks began with the post-Laramie uplift or closely followed, and from the time of the first appearance of these rocks volcanic eruptions continued with greater or less energy throughout Tertiary time. It is evident that from the time of the post-Laramie uplift there was, as shown in the geological history of the region, a succession of events of great importance in the development of the Rocky Mountains, and that each period of this history was characterized by distinct phases of volcanic phenomena."

The occurrence of several rare species of minerals, namely, pollucite, mangano-columbite and microlite, of Rumford, Maine, is described by H. W. Foote, with analyses and crystallographic details. A. J. Moses describes a simple method of plotting the axial cross for the crystals of any species. A. W. Pierce discusses the gravimetric determination of selenium by the use of potassium iodide.

AMERICAN CHEMICAL JOURNAL, MAY.

Transformations of Parasulphamine-benzoic Acid under the influence of heat: By IRA REMSEN and A. M. MUCHENFUSS. When parasulphamine-benzoic acid is heated to 285° a remarkable change takes place, consisting of the interchange of the amide and hydroxyl groups :



At lower temperatures other products are formed, among them being a diamide and a parasulphamine-benzoic acid different from the ordinary variety. The method of preparation and properties of these substances have been studied; but their structures are as yet unknown.

The heat of Electrolytic Dissociation of some acids. By F. L. KORTRIGHT: The author has studied the effect of difference of constitution on the heat of electrolytic dissociation and finds that certain groups produce definite thermal changes, which are however dependents on the relative position of the groups in the molecule.

On the existence of Pentaethyl Nitrogen: By A. LACHMAN. Although a number of methods were tried which it was expected would produce this substance, no evidence of its formation could be obtained.

The Conductivity of Solutions of Acetylene in water: By H. C. JONES and C. R. ALLEN. The authors show that some dissociation takes place in solutions of acetylene in water, as would be expected from its weak acid nature.

The use of Phenolphthalein in illustrating the Dissociation of Water: By H. C. JONES and C. R. ALLEN. A solution of ammonia in alcohol produces no color with phenolphthalein, as the ammonia is not dissociated by alcohol. When, however, water is added to this solution the color appears, its intensity being proportional to the amount of water added and, therefore, to the amount of dissociation caused by the water. Sodium and potassium hydroxides, however, are dissociated in alcohol and therefore produce the color in this solvent.

The action of Acid Chlorides on the Silver Salts of the Anilides: By N. L. WHEELER and B. B. BOLTWOOD. When silver formanilide is treated with benzoylchloride a diacidanilide is obtained

as the final product. In the present paper it is shown that an intermediate addition product is formed, which then breaks down into silver chloride and the diacidanilide. The reaction is similar to many studied by Nef.

On the existence of two Orthophthalic Acids: By W. T. H. HOWE. In this paper the cause of the difference in the melting point of orthophthalic acid as observed by a number of investigators is explained. The observations have been made probably with two different acids or mixtures of the two. Two have been isolated, which are alike in composition, molecular weight, and molecular refraction; but different in melting point, electrical conductivity, solubility, formation of salts with bases and reduction products. The author explains this case of isomerism by the difference in the arrangement of the double bonds of the Kekulé formula.

The Reduction of Permanganic Acid by Manganese Superoxide: By H. N. MORSE, A. J. HOPKINS and M. S. WALKER. The reduction which takes place in solutions of potassium permanganate and permanganic acid is shown to be due to the action of manganese superoxide. If the solutions, after standing a short time, are thoroughly filtered, they can be kept unchanged.

This number contains also a review of recent improvements in chemical industries, with special reference to sulphur, pyrites, sulphuric, hydrochloric and nitric acids, and reviews of Ostwald's *Klassiker*; Review of American Chemical Research, A. A. Noyes; Organic Chemistry, R. L. Whiteley; The Chemistry of Pottery, K. Langenbeck.

J. ELLIOTT GILPIN.

SOCIETIES AND ACADEMIES.

NEW YORK ACADEMY OF SCIENCES, MAY 18, 1896.

THE Academy met with President Stevenson in the chair.

The Section of Geology and Mineralogy at once organized.

The first paper of the evening was by Mr. Heinrich Ries entitled 'Notes of a trip through the Marble Quarries of Western New England

and Eastern New York.' Mr. Ries sketched out the geology and geographic distribution of limestone quarries along the Hudson and Lake Champlain Valleys passing north and the marble quarries in the Green Mountains and Berkshire hills coming south. His remarks were copiously illustrated by the lantern and by many beautiful specimens. The paper was discussed by Messrs. Martin, Dodge and Kemp, to whose remarks the speaker replied.

The second paper of the evening was by J. F. Kemp on 'The great Quartz Vein at Lantern Hill, near Mystic, Conn.' The speaker described the vein as about 400 feet in width and at least 1,200 feet in length. Its northern extremity forms the summit of Lantern Hill about 500 feet above sea level. This portion is of hard milky white quartz. The southern extension of the vein forms Long Hill. It is lower in altitude and largely composed of loose pulverulent quartz, which, however, perfectly preserves the comby structure of the quartz vein. It consists of innumerable interlocking masses of quartz crystals. It is but slightly iron stained in a few spots. It is so soft that it can be crumbled between the fingers and is easily dug with pick and shovel without any blasting. The vein strikes north about 15 degrees east and cuts squarely across the laminations of the gneiss. It is one of the largest quartz veins known in the East and is of very pure silica. Samples from the crumbly portion range from 98 to 99.4 SiO₂. A few rare scales of some micaceous or chloritic mineral are practically the only other ones present. Under the microscope the powdered quartz appears quite fresh and exercises a vigorous influence on polarized light. Some prism faces of quartz crystals show etched figures, but in general the evidence of corroding alkaline solutions is hard to find. The speaker was therefore led to refer the pulverulent character of the vein to the effects of a faulting or crushing movement, although he inferred on the spot the action of some corroding alkaline solution, presumably magnesian. The paper was discussed by Messrs. Dodge and Hovey.

The third paper of the evening was by J. F. Kemp and was entitled 'The Pre-Cambrian Topography of the Adirondacks.' The speaker

mentioned the curious outliers of Cambrian and Ordovician strata that have been discovered far up in the mountains from the main outcrops that skirt them. They lie in valleys in metamorphosed crystalline rocks, which valleys represent beyond question the old pre-Cambrian river valleys and which were filled with sediment by the encroaching sea of Cambrian and Ordovician time. Lake George is the largest example of this kind and contains remnants of Potsdam sandstone and Trenton limestone in its southern portion. The valley of Trout Brook, which lies just west of Rogers' Rock, at the north end of Lake George and that is separated from it by a high intervening ridge of gneiss, contains two outliers of Potsdam sandstone of a few acres in extent. In the valley of Putnam's Pond, in the western part of Ticonderoga township, there is another outlier of Potsdam sandstone. Both of these are shown on the map of Ticonderoga which accompanies the speaker's report to Prof. James Hall on this region, and which was published in 1895. Another isolated area of calciferous limestone is found on Schroon Lake, under Schroon Lake post office. It is a few acres in extent and the exposed rock is about 75 feet thick. It is about 350 feet above tide at its upper point. Down the lake and river valley it is nearly forty miles to the next Cambrian outcrop, which is below Hadley. The speaker also cited the little outlier of Trenton limestone near Wells, on the Sacondaga River, and the fact that the Cambrian and Ordovician sediments on the west side reach short distances into the areas of crystalline rocks and along the river valleys. He stated that all the outliers on the east side had a uniform northeasterly strike and a dip of 10 to 20 degrees to the northwest. He remarked that they occurred in the valleys of streams which are notably sluggish, explaining their slow movement by the fact that they flow in pre-Cambrian valleys, already nearly reduced to a base level. He referred their parallel strike and dip to the general warping of the surface in this region. Remarking the undoubted presence of faults in the later development of the topography he emphasized the evidence of this early erosion long before the time of fossiliferous

sediments. He added that the old river valleys had in part been determined by the presence of crystalline limestones. The paper was discussed by Messrs. Dodge and Hovey.

The last paper of the evening was by L. M. Luquer and H. Ries, and described an area of Augen-gneiss near Bedford, N. Y. It was read by Mr. Luquer, and will appear in full in the Transactions. The gneiss appears to have been originally a granitic rock that has been extensively crushed and sheared out into the augen structure. The original quartz has been mostly comminuted, but the Carlsbad twins of orthoclase have remained as augen.

The paper was discussed by Dr. E. O. Hovey, who cited the case of the sheared Eisenach quartz-porphyry in which the feldspars have been crushed, but the quartzes have been drawn out.

Mr. G. F. Kunz mentioned the following items as the meeting closed :

A meteoric stone weighing 31 ounces was seen to fall by Mr. J. F. Black, April 9, 1896, at 6:15 P. M., on his farm 9 miles east and one north of Ottawa, Kansas. This meteorite contains iron particles throughout and is of the characteristic stony variety.

A remarkable nugget of native silver weighing 448 ounces troy, was lately found five miles from Globe City, Pinal county, Arizona. The mass is a water-worn nugget, slightly oval, very compact, and on its surface is bright silver-white, showing that it is made up of strings of crystallized silver, whereas the interior of the entire mass contains more or less cerargyrite. It has been presented to the Lea Collection of American Minerals of the United States National Museum.

New Zealand promises, mineralogically, to be a country of surprises, and many interesting things are gradually being brought to light by the agate hunters from Oberstein, Germany, who are visiting it. Recently they have discovered some immense masses of rolled, rutilated quartz, weighing from 10 to 30 pounds each. The masses are penetrated by crystals of rutile, red, brown and yellow, many inches in length and of the fineness of hair. Occasionally the rutiles occur very sparingly; then again they are in such profusion as to give the

entire mass the appearance of being a matted mass of hair. One mass of 30 pounds was entirely of this character. A fifteen-pound mass contained a dozen or more crystals of rutile 45 cm. in length and from one-half to two mm. in diameter. Magnificent crystals of amethyst have also been found, one of which is entirely of gem-cutting material and weighs 550 penny-weights or $27\frac{1}{2}$ ounces troy. Topaz, blue and white is found in the same localities.

J. F. KEMP,
Secretary.

THE NEW YORK SECTION OF THE AMERICAN
CHEMICAL SOCIETY.

THE New York Section of the American Chemical Society held its usual monthly meeting in the chemical lecture room of the College of the City of New York on Friday evening, May 8th, with about fifty members present, Dr. Peter T. Austen presiding. In response to inquiries regarding the progress made by the committee appointed to canvass the matter of the organization of a chemical club, Prof. Austen stated that, in accordance with the instructions given, it had increased its numbers to fifteen and had held several meetings, to one of which the members of the New York sections of the American Chemical Society and of the Society of Chemical Industry, as well as manufacturers and gentlemen interested in the science and art of chemistry, business men and friends of chemistry were invited. The meeting was full and enthusiastic. The committee was instructed to increase its number to fifty or more and to push the organization of the club as rapidly as possible. It appears that there is not in existence in this or any foreign country any real chemical club, as differentiated from a chemical society. It is believed that the science and art of chemistry furnish so much that is characteristic that a chemical club may easily be made a unique organization.

Dr. A. R. Leeds, of Stevens Institute, read a paper on the 'Bacteria of Milk Sugar.' The author finds that the morphology, classification, physiology and botany of bacteria are so rudimentary and unsatisfactory that the most valuable methods of bacteriological investigation are still of a chemical nature, and the advances to

be made in the near future are to be looked for mainly on the chemical sides of the subject.

The author was interested to note in the progress of his work that precipitated zinc hydroxide, which is generally considered amorphous or gelatinous, is really crystalline.

Dr. H. W. Wiley, of the United States Department of Agriculture in Washington, offered a paper entitled, 'Recent Advances in Milk Investigations.' It treated of the bacterial theory of milk decomposition, the composition of woman's milk as compared with cows milk and the relative value of the two for infant food, and of the commercial standards which should be fixed for the milks sent to the city markets.

Investigations of the composition of milk, in its relations to the welfare of the human race, are largely confined to the determination of its value as a nutrient. From an economic point of view, the content of fat and other food constituents is of paramount importance, while from a purely chemical point of view the most important are perhaps the composition of the different proteid bodies and the changes which they undergo, spontaneously or under the influence of bacterial life.

The author reviewed the works of Soldner regarding the proteid content of human milk, and quoted the figures given by that authority for the average composition of human milk as follows:

Proteids.....	1.52 per cent.
Fat.....	3.28 per cent.
Sugar.....	6.50 per cent.
Ash.....	0.27 per cent.
Citric acid.....	0.05 per cent.
Undetermined.....	0.78 per cent.
Total dry substance.....	12.40 per cent.

The undetermined substance, 0.78 per cent., are mostly nitrogenous bodies not generally found in cow's milk and for this reason cow's milk can never be so diluted or altered as to properly supply the natural nutriment of the infant.

The nitrogenous decomposition products of the blood, chief of which are urea, hypoxanthin, kreatinin, sulfocyanic acid and lecithin, are uniformly found in milk.

Mr. Marston Bogert, of Columbia University, read a paper on 'Normal Heptyl Sulphocyanid.' He offered a brief sketch of the series of alkyl

sulphocyanides, giving the results of the investigations of Liebig, Lowig, Cahours, Medlock, Henry, Pelouze, Schmidt, Reimer and Upperkamp. The last work on the series was done twenty-one years ago.

Normal heptyl sulphocyanid is a colorless, mobile liquid, having a slightly alliaceous but rather pleasant odor and a specific gravity of 0.931 at 15 degrees C.

Dr. Austen exhibited an apparatus for lecture demonstration of the properties of the heavier gases.

WM. McMURTRIE,
Secretary pro tem.

CHEMICAL SOCIETY OF WASHINGTON.

THE eighty-seventh regular meeting was held Thursday, March 12, 1896, with the President, Dr. de Schweinitz, in the chair. There were 35 members present, and Dr. Andrew Stewart was elected to membership. Mr. F. P. Dewey read a paper on 'The Refining of Lixivating Sulphides.' Dr. Dewey's paper reviewed the leaching process and the treatment of the sulphide precipitates produced. He described the sulphuric acid process of treating the sulphides, in which they are treated in strong sulphuric acid to convert the sulphides into sulphates, after which the charge is treated with water, the silver precipitated by copper and melted, and the copper sulphate crystallized.

Prof. H. W. Wiley and E. E. Ewell read a paper on 'The Determination of Lactose in Milks by Double Dilution and Polarization.' They called attention to the arbitrary correction proposed by Wiley in the determination of lactose in milk in a paper published in Vol. 6, page 289, of the *American Chemical Journal*. This arbitrary factor had been found too small, and the object of the present investigation was to eliminate it altogether, and to determine the degree of the correction to be made for the volume of the precipitate in each case by double dilution and polarization. The method was worked out carefully on whole milk, skimmed milk and cream, and it was found that the correction for the volume of the precipitate should be determined in each particular instance, as it varied from less than three cubic

centimeters in skim milk to more than seventeen cubic centimeters in cream for 100 cubic centimeter flask. Citations were given to other papers in which objection was made to the optical method of determining lactose by reason of the fact that a dextrinoid body was sometimes found in milk, but the danger of error arising from this source is not great.

Prof. H. Carrington Bolton read a paper on 'Berthelot's Contributions to the History of Chemistry.' He reviewed his 'Collection des Alchimistes Grecs' (Paris, 1887; 3 Vols. 4to), and his 'La Chimie au Moyen Age' (Paris, 1893; 3 Vols. 4to), showing their scope, analyzing their contents, and indicating the important changes in chemical history resulting from Berthelot's studies. He also described briefly the character of the Greek papyri of Leyden, as well as the Arabic, Syriac and early Latin manuscripts. The origin of alchemical ideas concerning the transmutation of metals is attributed by Berthelot to attempts of Egyptian goldsmiths to make alloys which fraudulently imitated the precious metals. The Latin works said to be translated from the Arabic of Geber are shown to be fictitious, yet genuine writings of Geber are extant. The technology of the writers of the third to the twelfth century is disclosed in the volumes received.

The topic of discussion for the evening was 'Style in Chemical Books and Papers.' Dr. Wiley opened the discussion and was followed by Prof. Bolton, Prof. Seaman, Prof. Clarke, Prof. Munroe, Mr. Fireman and Dr. de Schweinitz.

A. C. PEALE,
Secretary.

BIOLOGICAL SOCIETY OF WASHINGTON, 261ST MEETING, SATURDAY, MAY 2.

L. O. HOWARD exhibited a picture of three young ladies, triplets, giving statistics on the subject of triplets and stating that it was very rare for all three to reach maturity. Frederick V. Coville exhibited a ball $3\frac{1}{2}$ inches in diameter, taken from the intestine of a horse. It was of a light brown color and felt-like consistency and was composed of the barbed hairs of the crimson clover, *Trifolium incarnatum*. When over-ripe crimson clover hay is fed to

horses the hairs, which up to the time of flowering are soft and flexible, but afterwards become stiff and needle-like, gather into balls, sometimes becoming large enough, as in the present instance, to clog the intestine and cause death through peritonitis or some related ailment.

Erwin F. Smith exhibited a photograph made from a poured gelatine plate, showing the bactericidal effect of direct sunlight. He stated that many parasitic bacteria are killed by light and remarked on the hygienic importance of flooding sick rooms and all living rooms with sunshine. This experiment was made with *Bacillus tracheiphilus*, the exposure being only three hours. The part of the gelatine plate which was covered from the light developed from 6,000 to 12,000 small colonies in each field of the microscope, so that the gelatine became grayish white. The part of the plate which was exposed to the direct rays of the sun, a middle star-shaped portion, was easily distinguishable from the rest of the plate on the second day, and appeared throughout the experiment (8 days) to be entirely free from colonies, but a careful microscopic examination at several different times showed that about one bacillus in a thousand had escaped. These are supposed to have been partially or wholly protected from the direct action of the light by germs lying above them. With longer exposures or thinner sowings all would undoubtedly have been destroyed.

D. LeRoy Topping stated that Mr. Pollard and himself had found *Ranunculus ficaria*, at the original locality on Rock Creek, below Pierce's Mill, where it had first been noticed twelve years before.

A. F. Woods showed a tomato plant which had been exposed to hydro-cyanic acid. The stems, petioles and midribs of the leaves were killed by the gas, but the softer tissues were not injured and were able to obtain all the water they required through the dead tissue.

L. H. Dewey spoke of the tumbling mustard, *Sisymbrium altissimum*, stating that it had been introduced into North America from Europe during the past 20 years, and during the past 15 years it has developed into a very troublesome weed in Assiniboia and Manitoba, N. W.

Canada. It combines the productiveness and hardness of the mustard with the distributing habit of the tumbleweed and threatens to become a most dangerous weed in the northern plains where tumbleweed and mustard thrive at their best. Prof. James Fletcher, of Ottawa, Canada, carefully estimated the number of seeds borne by a single well developed tumbling mustard at 1,500,000. This plant has been reported from nine localities in Minnesota, Iowa, Missouri and South Dakota, and from ballast ground at Philadelphia, and freight yards at Weehawken, New Jersey.

T. W. Stanton presented a communication on the Genus *Remondia* Gabb, stating that this molluscan genus from the Lower Cretaceous of Arivechi, Sonora, Mexico, which has hitherto been placed in the *Trigonidæ*, belongs to the *Crassatellidæ* and includes the later described genus *Stearnsia* White, from the Cretaceous of Texas.

B. T. Galloway read a paper on *Recent Advances in our Knowledge of the Plant Cell* briefly reviewing the early discoveries and giving in some detail the most recent contributions to the subject. A paper by C. L. Pollard on the *Purple-Flowered Stemless Violets of the Atlantic Coast* was read, in the absence of Mr. Pollard, by David White. Seven species were enumerated in addition to the Linnæan *V. pedata*, the author stating that botanists have differed remarkably in their conceptions of specific relationships in this genus; yet while there is much individual variation, the species do not intergrade to the extent usually supposed. The *Viola dentata* of Birch, *V. septemloba* of Le Conte, and *V. ovata* of Nuttall, were restored to specific rank.

F. A. LUCAS,
Secretary.

GEOLOGICAL SOCIETY OF WASHINGTON.

At the 49th meeting, held on May 13th, papers were presented as follows:

The Faunal Relations of the Eocene and Upper Cretaceous on the Pacific Coast: By T. W. STANTON. The Chico-Tejon series has been described as a continuous series, showing a gradual transition both faunally and stratigraphically from the Cretaceous into the Eocene, the close faunal connection being

found especially in the 'Martinez group' (an upper sub-division of the Chico), and in 'intermediate beds.' A study of the faunas and stratigraphy, especially in middle California, has proved that the intermediate beds and the upper part of the Martinez group are identical and that they form a lower zone of the Tejon, or Eocene. When the line between the two formations is thus located their faunas are but little more closely related than the Upper Cretaceous and Lower Eocene faunas of other parts of the world. With the exception of an Ammonite, of which a few specimens were reported from the Tejon in early collections, the few species that seem to be identical in the two formations are persistent types that have come down to the present day with little change.

The Structure and Age of the Cascade Range: By J. S. DILLER. The two sections of the Cascade Range afforded by the Klamath and Columbia Rivers expose volcanic rocks only and indicate that the range where most typically developed is composed essentially of lava from top to bottom. As far as yet known, it has no core of older metamorphic rocks on which the line of volcanoes developed.

He described the position and relations of the auriferous slate series.

At Ashland, in southern Oregon, the relations of the Cascade Range to the Klamaths is better exposed. They are separated by Rogue River Valley, which is cut chiefly in Cretaceous strata. Overlying these with apparent conformity, and dipping gently to the eastward beneath the Cascades are similar sedimentary rocks containing silicified wood, referred by Knowlton to a period certainly later than the Cretaceous. Above these and conformable with them on the western slope of the Cascades are numerous sheets of lava and tuff. One sheet of tuff near the base of the series contains Miocene leaves. Although the volcanic activity of the Cascade Range may have been initiated in earlier times, the period of greatest eruption and the upbuilding of the range occurred in the Neocene.

An Early Date for Glaciation in the Sierra Nevada: By WILLARD D. JOHNSON. The author described the occurrence of striated pebbles, of foreign material, in the extensive andesite-tuff

flows, or volcanic mud flows of the Sierra, and gave reasons for regarding the striation of these included pebbles as probably glacial. He then called attention to a certain anomalous topography of the summit region of the range, and offered for it an interpretation which, together with the presence of the presumably glacial pebbles in the deeply canyoned lavas, appeared to warrant the inference that glaciation here had a beginning coincident with the erection of the Sierra Nevada into a high range.

W. F. MORSELL.

U. S. GEOL. SURVEY.

ACADEMY OF NATURAL SCIENCES OF
PHILADELPHIA.

May 5, 1896.—DR. F. P. HENRY made a communication on *Filaria sanguinis hominis nocturna* specimens of which had been obtained from the blood of a patient suffering from chyluria due to clogging of the lymphatics by the ova of the parasite. The various forms of the worm and their life history as given by Dr. Patrick Manson were dwelt on. The parasite secretes no toxine and its presence in man is usually not productive of bad effects. The speaker stated his belief that the excretory products of parasites are hurtful to man in proportion to the lowness of their organization. The nocturnal Filariae appear in the superficial vessels about sunset and disappear about the time of rising. In patients induced to sleep during the day the periodicity is reversed. The only treatment is prophylactic as a drug which would kill the mature worm would, in all probability, be hurtful to the host by causing abscesses around the dead product.

Dr. Leonard, in continuation, dwelt on the morphology of the worm, illustrating his remarks by means of fine micro-photographs of the specimens described by Dr. Henry.

May 12.—DR. CHARLES S. DOLLEY described a centrifugal apparatus for the quantitative determination of the food supply of oysters and other aquatic animals which he called a Planktonokrit. By means of its use he is enabled to make a large number of plankton estimates in a day and thus judge of the characters of given areas of water in connection with fish and oyster culture at different times of the day, states of the tide, varying depths, etc.

The method employed is that of the centrifuge, an apparatus which consists of a series of geared wheels driven by hand or belt, and so arranged as to cause an upright shaft to revolve up to a speed of 8,000 revolutions per minute, corresponding to 50 revolutions per minute of the crank or pulley wheel. To this upright shaft is fastened an attachment by means of which two funnel-shaped receptacles of one litre capacity each may be secured and made to revolve with the shaft. The main portion of each of these receptacles is constructed of spun copper, tinned. When caused to revolve for one or two minutes the entire content of suspended matter in the contained water is thrown to the bottom of tubes properly placed, from which the amount may be read off by means of a graduated scale.

EDW. J. NOLAN,
Recording Secretary.

NORTHWESTERN UNIVERSITY SCIENCE CLUB,
MAY 1.

PROF. HOUGH in the chair and thirty-eight persons present. Prof. Crew and Mr. Basquin presented the topic, 'The Identity of Light and Electricity.' 'Kelvin's prediction that the discharge of the Leyden jar was (under certain conditions) oscillatory and Maxwell's equations for the propagation of electro-magnetic disturbances were derived and explained. The subject was illustrated by Faraday's experiment showing rotation of plane of polarization in a magnetic field. The nature of wave motion was shown by the Melde experiment, Kundt's tube and Weber's wave trough. The equivalence of capacity and self induction was illustrated by Lodge's experiment showing resonance between ten Leyden jars. The Lecher modification of the Hertz experiment was shown in various forms, the nodes of the electric waves being detected by vacuum tubes and bridges.'

A. R. CROOK,
Secretary.

EVANSTON, ILL.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

At the meeting of the Academy of Science of St. Louis of May 18, 1896, Professor C. M. Woodward presented a critical examination of some of the mathematical formulæ employed by Her-

bart to represent mental phenomena, in which these formulæ were criticised as inadequate. Though not considering any formulæ likely to be adequate, from the nature of the case, the speaker offered a substitute for the Herbart formulæ pertaining to the bringing into consciousness of a sublatent concept through the suggestion afforded by another concept similar in some respects while differing in others.

Dr. A. N. Ravold made a report on the use in St. Louis of diphtheria anti-toxine, prepared by the health department of the city. During the past winter 342 cases of diphtheria had been treated with this serum by 93 physicians. Doses of from 2.5 to 100 cc. had been administered. As a rule, the recovery was far slower when the quantity used was small than when a larger quantity was employed. Usually the serum was administered only once. In about half the cases a decided change for the better was noticeable within 24 hours, and these cases were practically cured within 48 hours, although attention was called to the fact that for some weeks the throat of a convalescent is a breeding place for the diphtheritic bacilli, the virulence of which did not seem to be diminished by the serum treatment. Of the cases reported on, 9.06 per cent. only died, and as a considerable number of cases were hopeless when treatment was administered, the patients dying within 24 hours thereafter, it was considered fair to deduct these deaths from the total, which reduced the mortality to 4.6 per cent. when the serum was administered in the earlier stages of the disease. The injurious consequences of administering the serum were fully considered, but held to be practically insignificant. It was also stated that when used on persons who had been exposed to, but had not manifested the disease, the serum proved an unfailing means of conferring immunity for a certain period of time. Among the advantages in the use of this serum was mentioned that of lessening the chances of secondary infection, so frequent after an attack of diphtheria.

A committee presented resolutions on the death of Dr. Charles O. Curtman, for many years a member of the Academy.

WM. TRELEASE,
Recording Secretary.